



**Carleton**  
UNIVERSITY

*Education  
for* **Life**

1999/2000

Graduate

Calendar



**1999/2000**

Graduate

Calendar

[www.carleton.ca](http://www.carleton.ca)



**Code No. Building Name**

AA	22	Architecture Building
TT	29	Carleton Technology and Training Centre
CC	28	Colonel By Child Care Centre
DT	21	Dunton Tower
EL	16	Environmental Laboratories
GH	18	Glenagary House
GR	14	Grenville House
HP	13	Herzberg Laboratories
LH	6	Lanark House
LS	25	Life Sciences Research Building
LA	15	Loeb Building
ME	10	Mackenzie Building
ML	2	MacOdrum Library
MB	11	Maintenance Building
MC	27	Minto Centre
PA	3	Paterson Hall
AC	9	Physical Recreation Centre
RH	5	Renfrew House
AB	17	Robertson Hall
RU	14	Russell House
SR	24	Social Sciences Research Building
SA	4	Southam Hall
SP	23	St. Patrick's Building
SC	12	Steele Building
SD	26	Stormont-Dundas House
TB	1	Tory Building
UC	7	University Centre
CO	19	University Commons

**Visitor Parking  
Only in these Locations**

Parking Garage (P9)

Parking Lot 1

Parking Lot 2

Parking Lot 5

Parking Lot 6

Parking Lot 8

- Bank
- Bookstore and Computer Store
- Bus Stops
- ◆ Carleton University Art Gallery
- ⬢ Entrances to Campus
- ? Information Carleton
- ❖ Post Office
- ⬢ Tunnel Entrance
- ⬢ Tunnel Entrance with Stairs
- ===== Tunnels



CP 255

# Carleton

UNIVERSITY

## Faculty of Graduate Studies and Research

### ***Graduate Calendar for the Academic Year 1999-2000***

1125 Colonel By Drive  
Ottawa, Canada  
K1S 5B6  
Telephone: (613) 520-2525  
Fax: (613) 520-4049

The *Graduate Calendar* is available at the Web site <http://www.carleton.ca>. Every effort has been made to ensure the accuracy of the electronic version, but in the case of any discrepancy, the printed *Calendar* shall be considered to be the University's official statement.

This *Calendar* is published several months in advance of the beginning of the academic year. The University reserves the right without liability or penalty, and without notice, to make changes in the services and programs it offers, including alteration of the fee schedule and cancellation of particular courses.

The arrival of the year 2000 is expected to affect computers, software and date dependent imbedded systems and threatens to disrupt day to day operations in many areas. The University is assessing, addressing and making appropriate contingency plans to avoid or minimize disruptions on the campus and to those dealing with the University. Students should also take measures within their control to ensure compliance and assume responsibility for their own contingency plans. **Carleton University hereby disclaims any liability whatsoever for disruptions to operations on the campus or connected thereto and disclaims any and all liability for damages, howsoever arising, out of any date or time recognition or 'Year 2000' disruption.**

## Office of the Dean

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*Dean of Graduate Studies and Research*  
Roger Blockley

*Associate Dean (Programs and Planning)*  
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*(Systems and Information)*  
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*Office Hours*  
September 1 to August 31  
10:00 A.M. - 12:00 noon  
1:00 P.M. - 4:00 P.M.



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## **Educational Equity Policy**

### ***Preamble***

In support of Carleton University's commitment to Section 15 of the Federal Charter of Rights and Freedoms, Sections 4 and 13 of the Ontario Human Rights Code, and the University's mission statement,

### ***Statement of Principles***

Carleton University is committed to providing equity in its educational programs and services and a welcoming environment for all individuals regardless of race, ancestry, place of origin, colour, ethnic origin, national origin, creed, sex, sexual orientation, age, marital status, family status, or disability as defined in the Human Rights Code of Ontario.

Carleton University strives for the best possible educational experience for all of its students. The University attempts, to the best of its ability, to encourage and assist all students to succeed academically and as members of the University community.

### ***Educational Equity Policy Statement***

In support of its commitment to excellence in teaching, scholarship, and research, Carleton University seeks to identify University policies, programs, and services that need to be changed, enhanced, or created, subject to the availability of resources, in order to:

- (a) increase the access, retention, and graduation of groups of students who have traditionally been under-represented, under-served, and/or disadvantaged in University programs, and
- (b) provide a supportive and welcoming learning environment for all students.

The designated groups for education equity include, but are not limited to: women; Aboriginal peoples; persons with disabilities; racial, ethnic, or visible minorities; the economically disadvantaged; mature and part-time students; gay men, lesbians, and bisexuals; and international students.

The University undertakes to provide reasonable accommodation to these groups and, to the extent that it is possible, to implement special measures to support the achievement of the University's education equity goals.

In support of its commitment to achieve and maintain a hospitable campus climate for all students, faculty, and staff, the University undertakes to provide education and training on human rights issues as these relate, inter alia, to curriculum and pedagogy.

## **Policy on Discrimination and Sexual Harassment**

Carleton University is a community of faculty, staff, and students who are engaged in teaching, learning and research. Its members are part of the community at large and are governed by the law common to all persons. But membership in the academic community also entails certain rights and responsibilities. The University respects the rights of speech, assembly, and dissent; it prohibits discrimination on the basis of race, ancestry, place of origin, colour, ethnic origin, national origin, creed, sex, sexual orientation, age, marital status, family status, political affiliation or belief, or handicap that is defined as such in the Human Rights Code of Ontario; it requires tolerance and respect for the rights of others; and it promotes an environment conducive to personal and intellectual growth.

(Please refer to Offences of Conduct, Academic Standing, p.64.)

# The University

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- Graduate Students Association*
- Health and Counselling Services*
- Housing and Food Services*
- Library*
- Ombuds Services*
- Paul Menton Centre for Persons with Disabilities*
- Student Life Services*
- University Centre*
- Writing Tutorial Service*

## Electronic Access to the Graduate Calendar

An electronic version of the Graduate Calendar is available on the Internet.

The electronic version is usually available within two months after the print version (i.e. by June 1). Every effort has been made to ensure the accuracy of this electronic version, but in the case of any discrepancy, the printed Calendar shall be considered to be the University's official statement.

The electronic version can be accessed by all users at <http://www.carleton.ca>. For those with campus CHAT accounts, the electronic version is also available under the Carleton Information option.



## The University

Carleton University is a contemporary, enterprising university situated in Canada's capital. Undergraduate and graduate programs are offered in the disciplines of arts, social sciences, engineering, and science and through many professional schools and institutes. Specialized research is carried out in more than 84 organized research centres. With 17,101 full-time and part-time students from the national capital region, from across the country, and from more than 107 countries around the world, Carleton has acquired a reputation that is world-wide.

Founded in 1942 as a non-denominational, private, co-educational college, Carleton initially occupied a few rented classrooms in church basements and high schools in downtown Ottawa. Full-time programs were offered in 1946 in journalism and public administration. Rapid expansion during the following years led to the development of a new campus on a large and picturesque site between the Rideau River and the historic Rideau Canal.

Carleton's location in Canada's capital has shaped its philosophy and character in a special way. Throughout its 54 year history, Carleton has explored the Canadian perspective in many fields and utilized Ottawa's unique resources to give its students an advantage that few other universities enjoy. In the pursuit of academic excellence, Carleton has played a national role in contributing to the quality of public discourse in Canada and to the advancement of our country's international relations. Looking to the future, the University is at the forefront in developing new partnerships, new programs, and new directions in teaching and research that will enable its graduates to lead in meeting the challenges of tomorrow. Forging ties with business, industry, government, and other educational institutions will ensure the most relevant education and most current leading edge research.

The first undergraduate degrees, awarded in 1946, were in journalism and in public administration, and the first graduate diploma in 1954 was in public administration. Today, the University offers graduate instruction leading to the master's degree in more than 50 fields and to the doctorate in 19 fields. In 1997-98, The Faculty of Graduate Studies and Research registered 2,412 students in full-time and part-time studies.

With outstanding scholars, challenging and imaginative programs, excellent students, libraries, laboratories, and other resources and facilities, the University can provide its students with the most current and relevant education. Graduate programs in science and engineering are enhanced by linking resources and expertise with the University of Ottawa to create institutes that are among the finest in the country. Moreover, students in all programs have access to the vast number of scholars working in government organizations and to the special facilities associated with these national and international institutions.

Carleton University's 29 buildings occupy a beautiful 62-hectare campus just 10 minutes drive south of Parliament Hill. A special feature of the campus is an extensive underground tunnel system which makes the University especially accessible for students who have mobility impairments. The Carleton University Library houses more than a million volumes and an extensive collection of microfilms, archival material, maps, documents, and prints, all accessed by an on-line catalogue system with terminals on every floor. Reading rooms and special interest resource centres are maintained by many departments on campus. Accommodations for over 1,600 students is provided in Carleton's seven residence buildings, and cafeterias throughout the campus offer meals and snacks. The physical recreation centre houses facilities for a wide range of activities from individual fitness to varsity and intramural team competition in a number of sports. Special-interest clubs, public lectures, concerts, films, live theatre, conferences, and conventions bring many dimensions to campus life.

Recreational, cultural, and leisure-time activities to suit every taste abound in the national capital area. The National Arts Centre, the Museum of Civilization, and the National Art Gallery enlighten and entertain in both English and French. Carleton boasts the world's longest winter skating rink, the Rideau Canal, at its doorstep, and miles of bike paths and walking trails surround the picturesque campus along waterways and greenbelts.

## Degree Programs

The following graduate programs are currently offered at Carleton:

### *Certificate in Conflict Resolution*

### *Certificate in Health and Social Policy in Development*

### *Graduate Diploma in Public Administration (D.P.A.)*

### *Master of Architecture (M.Arch.)*

### *Master of Arts (M.A.)*

Anthropology, Applied Language Studies, Canadian Art History, Canadian Studies, European and Russian Studies, Communication, Comparative Literary Studies, Economics, English, Film Studies, French, Geography, History, International Affairs, Legal Studies, Philosophy, Political Economy, Political Science, Psychology, Public Administration, Religion, and Sociology

### *Master of Computer Science (M.C.S.)*

### *Master of Engineering (M.Eng.)*

Aerospace, Civil, Electrical, Materials, Mechanical Engineering, and Telecommunications Technology Management

### *Master of Journalism (M.J.)*

### *Master of Management Studies (M.M.S.)*

### *Master of Science (M.Sc.)*

Biology, Chemistry, Earth Sciences, Information and Systems Science, Mathematics, and Physics

### *Master of Social Work (M.S.W.)*

### *Doctor of Philosophy (Ph.D.)*

Biology, Chemistry, Cognitive Science, Comparative Literary Studies, Communication, Computer Science, Earth Sciences, Economics, Engineering (Aerospace, Civil, Electrical, and Mechanical), Geography, History, Management, Mathematics, Physics, Political Science, Psychology, Public Policy, and Sociology.

Joint programs with the University of Ottawa are offered in the following areas: Civil Engineering, Electrical Engineering, Mechanical and Aerospace Engineering, Biology, Chemistry, Computer Science, Earth Sciences, Mathematics and Statistics, Physics, and Economics.

The Institute of Neuroscience collaborates with the University of Ottawa to offer a Specialization in Neuroscience.

The Departments of Biology and Chemistry offer a collaborative program in Chemical and Environmental Toxicology.

The Ottawa-Carleton Institute of Mathematics and Statistics and the Department of Epidemiology and Community Studies at the University of Ottawa collaborate to offer a Specialization in Biostatistics.

The Ottawa-Carleton Institute of Computer Science and the Department of Systems and Computer Engineering participate with ConGESE (Consortium for Graduate Education in Software Engineering) to offer a Specialization in Software Engineering.

The Norman Paterson School of International Affairs and the Common Law Section of the Faculty of Law at the University of Ottawa offer a joint Master of Arts in International Affairs and Bachelor of Laws degree (M.A./LL.B.)

## Academic Dress

The academic dress of Carleton University is a compromise between the style of hoods outlined in the American Intercollegiate Code and the dress of ancient foundations of Britain and America.

The master's hood, made of black silk, is of simple or Oxford shape with an open lining of two chevrons (red and black) on a silver field. The border of the hood denotes the degree granted, according to the following colour combinations: arts - white; journalism - white with a black cord sewn slightly in from the lower border; management studies - camel brown with a black cord sewn slightly in from the lower border; science - golden yellow; computer science - royal blue; social work - cream; architecture - cerise; engineering - orange. The Master's gowns, to be worn with the above hoods, are of full length, made of black stuff, with a gathered yoke behind, and long open-fronted sleeves.

The Doctor of Philosophy hood is also made of silk, but completely opened to show the lining, and provided with a purple border. The Doctoral gown is of full style, made of fine royal blue cloth with facings of light blue silk, with a full gathered yoke behind, and closed sleeves with an opening at the elbows.

The gown of the Honorary Doctorate of Laws, Literature, Science, Engineering, Architecture, or Fine Arts is a blue robe with bell-shaped sleeves, made of fine royal blue cloth with facings and sleeves in light blue silk. The hood is made of the same material as the gown, has the same lining as that for the degrees granted by examination, and is bordered with purple for the degree of Doctor of Laws, vibrant blue for the degree of Doctor of Literature, dark red for the degree of Doctor of Science, orange for the degree of Doctor of Engineering, cerise for the degree of Doctor of Architecture, and dark cardinal for the degree of Doctor of Fine Arts.

## Academic Schedule

The following schedule contains the dates prescribed by the University Senate for academic activities. Dates relating to fee payment, cancellation of course selections, late charges, and other fees or charges will be published in the Important Dates and Deadlines section of the 1999-2000 *Registration Instructions and Class Schedule* booklet.

### Spring/Summer Term 1999

#### May 14

- Last day for submission to the Office of the Faculty of Graduate Studies and Research of the five (5) final copies of Master's and Ph.D. theses for Spring convocation.

#### May 17

- Spring/summer-term classes begin (full-session and First-term courses).

#### May 24

- Statutory holiday. University closed.

#### May 25

- Last day for registration for spring/summer term. Last day for course changes for First-term evening division courses and for evening division full-session courses. Students who have not yet deposited five (5) final copies of their thesis in the Office of the Faculty of Graduate Studies and Research must register.

#### June 10-12

- Spring Convocation for the conferring of degrees.

#### June 11

- Last day for withdrawal from First-term courses.

#### June 25

- Last day for classes for First term. (Full-session courses resume July 5.)

#### June 28-30

- First-term final examinations may be scheduled. **It may be necessary to schedule examinations for evening classes during the day and vice versa.**

#### July 1

- Statutory holiday. University closed. Evening classes missed may meet on July 12.

#### July 5

- Second-term classes begin.

#### July 30

- Last day for withdrawal from full-session courses and Second-term courses.

#### August 2

- Civic holiday. University closed. Evening classes missed may meet August 6.

#### August 13

- Last day for spring/summer-term classes.

#### August 14-18

- Spring/summer-term examinations may be scheduled as announced. **It may be necessary to schedule examinations for evening classes during the day and vice versa.**

### Fall Term 1999

The Faculty of Graduate Studies and Research normally admits students to begin their programs in the Fall term. However, some academic units may consider applicants in the Winter term or the Spring/Summer term. Applications for admission may be submitted at any time. Applications from outside Canada should be completed at least five months before the desired date of admission in order for students to make the necessary visa arrangements.

Applicants wishing to be considered for financial assistance from Carleton University are reminded that they must submit their completed applications before March 1. **Please note that some schools and departments may require completed applications prior to March 1. Students must refer to departmental entries in this calendar for details.**

#### August 1

- Last day for submission to the thesis supervisor of six (6) examination copies of Master's and Ph.D. theses for Fall graduation.

#### September 1

- Last day for receipt of applications for degrees from potential Fall graduates.

#### September 4

- Fall term begins.

#### September 4 - 11

- PrepWeek. Academic and social orientation to the campus.

#### September 6

- Statutory holiday. University closed. PrepWeek activities continue.

#### September 7 - 8

- Academic Orientation. **All students are expected to be on campus.** Class and laboratory preparations, departmental introductions for students, and other academic preparation activities will be held.

*Note:* Some graduate courses in joint programs with the University of Ottawa will begin formal classes on this date. Graduate



## Academic Schedule

students are advised to check with their departments for details.

### September 8

- Orientation for Graduate Teaching Assistants.

### September 9

- Graduate Fall and Fall/Winter classes begin.

### September 24

- Last day for registration. Students who have not yet deposited the five (5) final copies of their thesis in the Office of the Faculty of Graduate Studies and Research must register.
- Last day to change courses or sections for Fall/Winter and Fall-term courses.

### October 8

- University Day at Carleton. Undergraduate classes suspended.

### October 11

- Statutory holiday, University closed.

### October 14

- Last day for submission to the Office of the Faculty of Graduate Studies and Research of five (5) final copies of Master's and Ph.D. theses for Fall graduation.

### November 5

- Last day to withdraw from Fall-term courses.

### November 21

- Fall convocation for the conferring of degrees.

### December 1

- Last day for receipt of applications from potential Winter (February) graduates
- Last day for submission to the thesis supervisor of six (6) examination copies of Master's and Ph.D. theses for Winter graduation.

### December 6

- Last day of Fall-term classes.
- Fall Term ends.

### December 9 - 22

- Final examinations in Fall term courses and mid-term examinations in Fall/Winter courses will be held. **It may be necessary to schedule examinations during the day for classes held in the evening and vice versa.**

## Winter Term 2000

### January 5

- Winter term and Winter-term classes begin.

### January 18

- Last day for late registration for Winter-term courses.
- Students who have not yet deposited the five (5) final copies of their thesis in the

Office of the Faculty of Graduate Studies and Research must register.

- Last day to change courses or sections for Winter-term courses.

### January 30

- Last day for submission to the Office of the Faculty of Graduate Studies and Research of the five (5) final copies of Master's and Ph.D. theses for Winter (February) graduation.

### February 1

- Last day for receipt of applications from potential Spring graduates.

### February 21 - 25

- Winter Break, classes suspended.

### March 1

- Last day for receipt of applications for admission from candidates who wish to be considered for the initial award (April) of financial assistance (including Carleton fellowships, scholarships, and departmental assistantships) administered by Carleton University. Candidates whose applications are received after the March 1 deadline date may be eligible for the award of a fellowship, scholarship, or assistantship by reversion.
- Last day for submission to the thesis supervisor of six (6) examination copies of Master's and Ph.D. theses for Spring graduation.

### March 10

- Last day to withdraw from Fall/Winter and Winter-term courses.

### April 4

- Last day of Fall/Winter and Winter-term classes.
- Some graduate courses may continue during Review Week until the end of Winter term on April 7.

### April 5 - 7

- Review Week.

- Some lectures, laboratories, review tutorials, etc. may take place.

### April 7

- Winter term ends.

### April 10 - 29

- Final examinations will be held. **It may be necessary to schedule examinations during the day for classes held in the evening and vice versa.**

### April 21

- Statutory holiday, University closed

### June

- Spring convocation for the conferring of degrees, date to be announced.



# 1999

JANUARY						FEBRUARY						MARCH						APRIL									
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
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31																											
MAY						JUNE						JULY						AUGUST									
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30	31																										
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26	27	28	29	30			24	25	26	27	28	29	30	28	29	30					26	27	28	29	30	31	
							31																				

# 2000

JANUARY						FEBRUARY						MARCH						APRIL											
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S		
						1					1	2	3	4	5				1	2	3	4					1		
2	3	4	5	6	7	8	6	7	8	9	10	11	12	5	6	7	8	9	10	11		2	3	4	5	6	7	8	
9	10	11	12	13	14	15	13	14	15	16	17	18	19	12	13	14	15	16	17	18		9	10	11	12	13	14	15	
16	17	18	19	20	21	22	20	21	22	23	24	25	26	19	20	21	22	23	24	25		16	17	18	19	20	21	22	
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MAY						JUNE						JULY						AUGUST											
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S		
						1					1	2	3							1	2	3	4	5				4	5
7	8	9	10	11	12	13	4	5	6	7	8	9	10	2	3	4	5	6	7	8		6	7	8	9	10	11	12	
14	15	16	17	18	19	20	11	12	13	14	15	16	17	9	10	11	12	13	14	15		13	14	15	16	17	18	19	
21	22	23	24	25	26	27	18	19	20	21	22	23	24	16	17	18	19	20	21	22		20	21	22	23	24	25	26	
28	29	30	31				25	26	27	28	29	30		23	24	25	26	27	28	29		27	28	29	30	31			
														30	31														
SEPTEMBER						OCTOBER						NOVEMBER						DECEMBER											
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S		
						1					1	2	3	4						1	2	3	4					1	2
3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11		3	4	5	6	7	8	9	
10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18		10	11	12	13	14	15	16	
17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25		17	18	19	20	21	22	23	
24	25	26	27	28	29	30	29	30	31					26	27	28	29	30				24	25	26	27	28	29	30	
																						31							

## Course Designation System

### Prefix Numbering

Each course number is prefixed by the number or numbers of the department, institute, or school under whose auspices the course is offered.

- 03 Interdisciplinary Social Sciences
- 07 Cognitive Science
- 09 Women's Studies
- 11 Art History
- 12 Canadian Studies
- 17 Comparative Literary Studies
- 18 English
- 19 Film Studies
- 20 French
- 22 German
- 24 History
- 28 Journalism and Communication
- 29 Linguistics and Applied Language Studies
- 30 Music
- 32 Philosophy
- 34 Religion
- 38 Spanish
- 42 Business
- 43 Economics
- 44 Political Economy
- 45 Geography
- 46 International Affairs
- 47 Political Science
- 49 Psychology
- 49 Specialization in Neuroscience
- 50 Public Administration
- 51 Law
- 52 Social Work
- 53 Sociology
- 54 Anthropology
- 55 European and Russian Studies
- 61 Biology
- 65 Chemistry

- 67 Earth Sciences
- 70 Mathematics and Statistics
- 74 Physics (joint program) offered at University of Ottawa
- 75 Physics
- 76 Architecture
- 77 Architecture
- 78 Architecture
- 82 Civil and Environmental Engineering
- 83 Civil Engineering (joint program) offered at University of Ottawa
- 85 Industrial Design
- 88 Mechanical and Aerospace Engineering
- 89 Mechanical and Aerospace Engineering (joint program) offered at University of Ottawa
- 92 Electrical Engineering (joint program) offered at University of Ottawa
- 93 Information and Systems Science
- 94 Systems and Computer Engineering
- 95 Computer Science
- 96 Telecommunications Technology Management
- 97 Electronics

### Course Numbering Pattern

The course numbering pattern is, in general, as follows:

- 001-099 Courses usually taken in Qualifying University year
- 100-199 Courses usually taken in First year
- 200-299 Courses usually taken in Second year
- 300-399 Courses usually taken in Third year
- 400-499 Courses ordinarily taken in Fourth-year engineering, architecture, and fourth-year (honours) arts, social sciences, science, and computer science
- 500-599 Courses ordinarily taken by graduate students
- 600-699 Courses ordinarily taken by graduate students

## Hours of Operation

### Bookstore

The following hours are subject to change.

*Labour Day to May*

Monday to Thursday 9:00 A.M. - 7:00 P.M.

Friday 9:00 A.M. - 4:30 P.M.

There will be no refunds or exchanges without the Bookstore cash register receipt. Refer to the Bookstore refund/exchange policy, located in the store, for further details.

### Library

The following hours are subject to change.

*Fall/Winter Terms*

Monday to Friday 8:00 A.M. - 11:00 P.M.

Saturday and Sunday 10:00 A.M. - 11:00 P.M.

*Spring/Summer Intersessions*

Monday to Friday 9:00 A.M. - 5:00 P.M.

Saturday and Sunday Closed

*Summer Term*

Monday to Thursday 8:30 A.M. - 10:00 P.M.

Friday 8:30 A.M. - 5:00 P.M.

Saturday Closed

Sunday 12:00 NOON - 5:00 P.M.

The Library closes for all holidays except Good Friday and Easter Monday.

For current Library hours, call 520-5621 or visit the Library's web site at [www.library.carleton.ca](http://www.library.carleton.ca).

## Student Services

### Athletics and Recreation

Telephone: 520-4480

The mandate of the Department of Physical Recreation and Athletics is to enhance campus life, spirit, and health by providing a variety of opportunities for high-quality physical activity which meet the needs of students and staff. A balance of programs is offered for all skill and competitive levels, including free-lance recreation, instruction programs, intramural sports, and interuniversity athletics.

The athletic facilities include an L-shaped fifty-metre pool with diving tower; a Fitness Centre with weight-training equipment, and cardiovascular machines; nine International squash courts; a double gymnasium; a heavy-weight training room; and Combatives and Multipurpose rooms. Outdoor facilities include football and soccer fields, three other playing fields, and five tennis courts. These facilities may be available to students either for recreational needs or for organised competition.

Instructional classes offered include group fitness programs such as aerobics, weight-training, and step aerobics; personal training services; fitness appraisals; aquatics programs such as learn-to-swim, aquafit, and masters' swim; dance; martial arts; yoga and tai chi.

For further information on varsity athletics, competitive club teams and intramurals, contact the Athletics department or visit our website at [www.carleton.ca/athletics](http://www.carleton.ca/athletics).

Full-time graduate students are eligible for interuniversity athletics, subject to league regulations. There is an Athletics Board which advises the Department and the University on matters of athletics and recreation policy through the Office of the President. The Board is composed of members from the Faculty, Administration, Alumni, the Students' Associations, and the Residence Association.

### Bookstore

Telephone: 520-3832

The University Bookstore, located in Southam Hall, stocks required textbooks and offers a wide selection of scholarly and general books. A complete line of school supplies and insignia clothing and gifts is also available.

Bookstore hours are: Monday through Thursday, 9:00 a.m. to 7:00 p.m., Friday 9:00 a.m. to 4:30 p.m. Hours are subject to seasonal changes

and will be posted at the Bookstore entrance. Customers are urged to call ahead if they are not clear on the hours.

The Bookstore's refund/exchange policy requires merchandise to be returned within 48 hours of purchase. There is an extended refund period at the beginning of each term. Customers are urged to review the policy before making a purchase. The cash register receipt is required for any refund or exchange.

### Career Services

508 University Centre

Telephone: 520-6611

Fax: 520-5695

Website: [www.carleton.ca/career](http://www.carleton.ca/career)

Email: [career@carleton.ca](mailto:career@carleton.ca)

Career Services (CS) is the on-campus career and employment centre. It provides students and alumni with the resources and materials they need to embark upon their job search. Services provided by this office include:

#### Resource Centre

A resource centre is available for students to research educational, employment, and career planning resources. Materials available include: occupational materials, university and community college calendars, company videos and CD Roms, job search materials, newspapers, business periodicals, occupational and labour market trends, work abroad information, salary information, an assortment of employment directories and information on various associations. Information about other sources of assistance at Carleton and in the greater Ottawa community is also available. There is a library of materials that are available on a loan system.

#### Career and Employment Counselling

Educational and career counselling involves learning to plan wisely, handle difficulties and make decisions with regard to academic and career concerns. Relevant information generated by group discussion and assessment is used in helping the student to determine goals and make choices. In addition, group workshops, dealing with employment issues, are held on a weekly basis on resume writing/cover letters, interview techniques and job search/networking skills. Students and alumni may register to attend by signing up with our reception staff.

#### Job Postings

Part time, summer and internship opportunities are posted on the self-service job boards within the office. Full time jobs are posted in job binders located in the reference library. Students may also access the Job Bank, situ-



ated on the 4th floor of the Unicentre, to search for jobs posted by Human Resources Development Canada. CS also provides computer work stations for students to access electronic job search methods such as the National Graduate Register and Campus WorkLink.

A selection of jobs advertised at Career Services appear on our homepage and in our Charlatan ad, which runs every second week during the fall and winter terms. Copies of the ad are circulated to departments on campus for posting. A detailed description of employment activity is published in our Employment Bulletin. The bulletin is posted in a glass case outside the office.

### **Career Fair**

Career Services hosts an annual Career Fair early in October. Employers from both the private and public sectors visit the campus to answer student inquiries and raise awareness of permanent job opportunities and career possibilities. The Career Fair date, time and location will be advertised in our September/October Charlatan ads.

### **Summer Job Fair**

During the last week in January or first week in February, Career Services hosts a Summer Job Fair. Various employers participate in the job fair to advertise their summer employment opportunities to all students currently enrolled in full time or part time studies. The Summer Job Fair will also be advertised through the Charlatan ad.

### **Employment Information Events**

Throughout the year, CS organizes a number of career and employment information events for students to provide them with the opportunity to gather information on various career possibilities. Some of these sessions may include on-campus visits from various employers and associations to discuss career opportunities, information sessions on government employment programs, and presentations from various representatives to provide students with information on working abroad.

### **On Campus Recruiting**

Employers from both the private and public sectors visit Carleton University to recruit graduating students for permanent employment opportunities which are available at the end of the academic term. Positions advertised through the program are of a professional nature. Students seeking employment through the On-Campus Recruitment Program must be in their graduating and final year of studies at Carleton University. The recruiting season takes place during both the fall and winter terms. On-Campus Recruiting

job postings are also advertised through our Charlatan ad and the Employment Bulletin.

### **Alumni Referral Service**

The Alumni Referral Service is for new and recent Carleton graduates. It is based on informing qualified Carleton alumni, registered with our service, of immediate job openings. All positions are also posted in the full time job binders in the reference library.

Students may register for the Alumni Referral Service one month prior to completing their degree requirements and may continue to register and participate in the service for up to three years after graduation. Students do not have to be unemployed to be eligible for the service, but they must be sincerely and actively looking for a job.

### **Carleton University Students' Association**

University Centre 401

Telephone: 520-6688

Fax: 520-3704

The Carleton University Students' Association (CUSA) is an incorporated, student-run organization that promotes the interests of the student body. All registered full or part-time undergraduate students are members of CUSA.

CUSA represents the students' interests to all levels of government and administration. It is also a member of the Canadian Federation of Students (CFS) and CFS-Ontario. These two organizations are committed to bringing about necessary educational, administrative and/or legislative changes in those areas affecting students.

Student services funded wholly or in part or operated by CUSA include: Career and Placement Services (by direct student levy); Carleton Disability Awareness Centre; Carleton Foot Patrol; Gay, Lesbian, Bisexual and Transgendered Centre; Information Carleton; International Students' Centre; Mature and Part-time Students' Centre; New University Government; Off-Campus Students' Lounge; Photo Centre; Women's Centre; and the Volunteer Centre.

CUSA business ventures include: Oliver's Pub and Patio; Rooster's Coffeehouse; Unicentre Store; and a Canada Post outlet.

The legislative body of CUSA is a 34 member Students' Council made up of representatives from each faculty and a President and Finance Commissioner who are elected annually by the student population. Elections take place in February. The term of office is twelve months commencing the following May.



## Student Services

CUSA also sponsors more than 100 clubs and societies, alternate education programs, speaker series, and concerts.

The Students' Association is continually working to improve and expand its scope of activities. Students are encouraged to communicate ideas and opinions to members of their elected representatives in CUSA, to participate and become actively involved in the activities of the Association, and to exercise their voting privileges.

### The Chaplaincy

Protestant-Ecumenical Chaplaincy  
T28, T30 Tory Tunnel  
Telephone: 520-4449

Roman Catholic Chaplaincy  
127G University Centre  
Telephone: 520-2896 or 520-2590  
*Chaplain*, Father Don Maclellan  
*Assistant Chaplain*, Deacon Derek G. Smith

For over three decades a chaplaincy service has existed at Carleton. Part of its function is to share experiences, insights, friendships and our faith. We are also involved in study and discussion groups, community projects, development education, marriage preparation and religious services. In addition, we have connections with many organizations and resources on campus as well as with churches and religious groups in the Ottawa area.

The two principal chaplains (Protestant-Ecumenical and Roman Catholic) are supported by a number of people in the Chaplaincy offices, which are open most days. Appointments are not necessary but at times they are advisable. People are encouraged to visit the offices at any time.

Next to the offices in the Tory Tunnel there is a Quiet Room, which is used for individual meditation, religious services (times posted), and prayer group activity. It is open all day, five days a week. Check with the Chaplaincy office regarding special services.

### Colonel By Child-Care Centre

Telephone: 520-2715  
Fax: 520-3992

Colonel By Child Care Centre has been providing non profit Child Care on the Carleton University campus for over 20 years. Qualified teachers care for 57 children between the ages of 6 months and 5 years. The Centre operates twelve months a year, Monday to Friday from 8:00 a.m. to 5:45 p.m. Fee subsidies from the Regional Municipality of Ot-

tawa-Carleton are available for families who meet the criteria.

As there is a waiting list, parents are encouraged to apply as early as possible.

For further information, please contact Margot Henderson.

### Computer Store

Telephone: 520-3699

The Computer Store, located in Southam Hall, carries a full range of computer products, (including Apple, IBM, NEC Bell, and Compaq computers, printers, modems, software and other peripherals) at very competitive prices, for students, faculty and staff.

Store hours:

Monday to Thursday

9:00 a.m. - 5:00 p.m.

Friday 9:00 a.m. - 4:30 p.m.

Closed weekends and statutory holidays.

Summer hours are posted at the entrance.

### Computing and Communications Services

401 Robertson Hall  
Telephone: 520-3700

A wide range of computer services are available to students. There are several Sun systems running Unix, as well as a number of microcomputer networks. All students are eligible for accounts on the CHAT system, an electronic communication system for e-mail, course discussion groups and Internet access. Also, all students have access to word processing spreadsheet and database software as well as laser printing facilities and CD-ROM services at the microcomputer labs on campus. Student Consultants are available at the microcomputer labs during peak times.

Comprehensive data analysis packages such as SAS, SPSS, Maple, Mathematica and Matlab are available for general research applications. Complete information about computing on campus is available to all students through the campus-wide information gopher see <http://www.carleton.ca/CCS>.

For information or assistance, please visit the CCS Help Desk in 401 Robertson Hall or call 520-3700. Handouts on various computing topics are available for pick up.

### Equity Services

22<sup>nd</sup> Floor Dunton Tower  
Director, Ingrid Wellmeier

Equity Services consists of the Centre for Aboriginal Education, Research and Culture,

the Mediation Centre, the Race Equity Office and the Status of Women Office. The role of Equity Services at Carleton is to promote equity, accommodate diversity and prevent discrimination. Proactive work includes workshops on diversity, cultural sensitivity, anti-racism, conflict resolution, mediation, harassment prevention as well as research on aboriginal issues. Each office has an extensive collection of publications and up-to-date research in their respective areas. Staff mediates conflict between individuals or among groups, works to resolve complaints of harassment or discrimination and provides advice to students, staff and faculty.

### **The Centre for Aboriginal Education, Research and Culture**

2206 Dunton Tower  
Telephone: 520-2600 ex. 4500  
Fax: 520-2512

Director, Armand Garnet Ruffo

The CAERC exists to ensure Aboriginal representation and presence on campus. It provides consultative services on First Nations, Metis and Inuit matters and pursues specific educational, research and cultural projects in co-operation with students, faculty, staff and the community at large.

The CAERC is also host to the Carleton First Nations student club.

### **The Mediation Centre**

2211 Dunton Tower  
Phone: 520-5765  
Fax: 520-4024  
E-mail: rramkay@ccs.carleton.ca

The Mediation Centre offers assistance to individuals and groups in conflict at the University. Students, staff and faculty can access the Centre for free. Training, group facilitation, mediation, conciliation, chairing of meetings, strategic planning leadership, prevention and de-escalation, team building and problem-solving facilitation, consultation and advice are available upon request from the Centre. The Mediation Centre uses a collaborative problem-solving process by which individuals and groups in conflict identify and resolve their problems with their conflicts with the help of an impartial third party who has no decision-making power. Roommate, landlord-tenant, interpersonal relationships, neighbourhood, sexual harassment, and human rights are some of the disputes handled through the Centre.

Every September, the Centre recruits volunteers among faculty, staff, students and Ottawa South residents and trains them as mediators. Please contact the Centre if you are interested

in becoming a volunteer. The Centre also offers academic and teaching support and hosts an annual Symposium on Conflict Resolution in February. Please contact the Centre for more information.

### **Race Equity Office**

2209 Dunton Tower  
Telephone: 520-5645  
Fax: 520-4037

Co-ordinator, Dr. Edward Osei Kwadwo Prempeh

Carleton University is host to students from various racial, cultural and ethnic backgrounds. The University has a well-established reputation for its commitment to excellence in diversity, and the Race Equity Co-ordinator works collaboratively with a wide range of students, faculty, staff and senior administrators to promote diversity as an institutional value and develop campus-wide educational programs to assist in broadening their knowledge and sensitivity to cultural and racial diversity.

The Office deals with complaints of racial discrimination and harassment and provides a confidential advisor service to complainants. The Office also offers workshops on topics such as employment and educational equity, 'chilly climate', and racism. These workshops are available to campus groups, student organizations, departments, classes, or by request.

### **Status of Women Office**

2201 Dunton Tower  
Telephone 520-5622  
Fax: 520-4037

Ingrid Wellmeier

Staff in the Status of Women Office work with various committees on campus to improve women's access to education, employment and services. Assistance is provided in locating childcare, resolving harassment complaints, personal and campus safety, date rape and sexual assault, lack of accessibility, sexism, employment and education equity, and chilly climate. Services are available to all students, faculty and staff.

### **Graduate Students' Association**

University Centre 600  
Telephone: 520-6616  
Fax: 520-3680  
E-mail: gsa@carleton.ca

The Graduate Students' Association (GSA) represents the collective interests and promotes the general welfare of the graduate students of Carleton University. The Association promotes and maintains communications between the graduate students and the Univer-

sity administration and represents graduate students within the University. The GSA can aid individual graduate students with specific problems related to the University community. The Association also acts to stimulate social, intellectual and political contact among graduate students.

The GSA Council is comprised of annually elected student representatives from each department, a four-member Executive (Internal Directors) and two External Directors. The Council meets on a monthly basis. For more information on becoming a GSA Councilor, contact the GSA office.

The Association owns and operates two separate lounges: Mike's Place (520-6681), a pub on the second level of the Unicentre; and the Gekko Grotto (ext. 8783), a coffee and computer lounge on the sixth level of the Unicentre. For full information on GSA services, please refer to the Graduate Student Handbook: Manual and Daily Planner, available from the GSA, your department, or Graduate Studies.

## Health and Counselling Services

Suite 2600  
Carleton Technology and Training Centre  
Telephone: 520-6674

Health and Counselling Services is your wellness centre at Carleton University. The centre offers a wide range of services, including treatment of illness, immunizations, birth control information, travel medicine information, a health education program, and much more. Our counselling services has professionally trained counsellors and psychiatrists to help with personal and emotional difficulties. All health records are confidential and will not be released to anyone without client written consent.

Our hours are from 8:30 a.m. to 4:30 p.m. (May - August) and 9:00 a.m. to 6:00 p.m. (September - April). Appointments are encouraged and may be made in person or by calling 520-6674. If you feel you need medical assistance before an available appointment, please feel free to walk in and a member of our health care team will make an initial assessment and direct further care as needed.

After-hours medical services are available from Holland-Carling After Hours Clinic located at 476 Holland Ave., (at Carling), phone 722-9689. When you call to book an appointment please identify yourself as a Carleton student.

Psychiatrists are available on a referral basis for those requiring psychiatric assessment or

care. The services provided are available to all students of the University, and are covered by provincial health insurance.

Counsellors are available to see students on a self-referral basis. Along with regular counselling appointments, our counselling staff offers "drop-in" times daily, for students needing short but immediate contact with a counsellor. Personal counselling can help individuals deal more effectively with emotional and social concerns.

A Health Education Program, promoting healthy lifestyles and wellness, offers on-going workshops presented by trained student peer educators. Topics include, but are not limited to, nutrition, alcohol, sexuality, stress management and smoking cessation. For more information, call the Health Educator at 520-6676.

## Health Insurance

### 1. Ontario Students

Carry your health insurance number with you at all times. If you do not have one, application for coverage must be made directly with the Ministry of Health at 75 Albert Street in Ottawa.

### 2. Students from Another Province

If you are from outside of Ontario, check that your health insurance is active and carry your number with you at all times. We don't bill you, we bill your provincial insurance plans directly.

### 3. Students from Outside Canada

The University Health Insurance Plan (UHIP) is compulsory for all international students upon registration. Further information regarding UHIP may be obtained from the foreign student advisor, the International Student Centre or Carleton International.

If you do not have any health insurance, you may be billed for services rendered. The University may withhold the marks of students with outstanding accounts.

## Immunization Record

It is recommended that new students:

1. Check with your family physician to ensure adequate immunization. An updated tuberculin skin test is recommended.
2. Obtain documentation of vaccination to red measles, German measles, mumps, polio and tetanus from your family physician. A booster dose of measles/mumps/rubella vaccine is recommended if you have not been re-immunized since infancy.
3. Discuss Hepatitis B vaccine with your family physician. The Medical Office of Health



for Ottawa-Carleton region strongly recommends it for all adolescents and young adults.

## Housing and Food Services

261 Stormont House

### Residences

Telephone: 520-5612

Fax: 520-3952

E-mail address: accommodations@carleton.ca

Carleton's student residence complex is home to over 1,600 students each academic year. Graduate students are housed in a separate building, which has single rooms in single sex or co-educational environments. Washrooms are shared between two rooms. The building also has study and television lounges, a laundry room, and open space for relaxation or group discussions.

Students' rooms are equipped to meet the basic needs of students, including individual Ethernet access to existing computer systems at Carleton University, including CHAT and the World Wide Web. (Additional cost for hook-up).

The Residence fee includes provision of a meal plan, in which all students must participate. There are three available meal plans: Plan A which provides 14 meals per week (lunch and dinner) or Plan B which provides 12 meals per week and a cash component of \$300 to be spent at any University-operated food outlet. Plan C provides nine meals per week (lunch and dinner) and a cash component of \$750.

A Vista 150 phone is provided for each student. These phones include call display, automatic local phone service and optional long distance access.

In addition, there is a fully equipped kitchen located in Renfrew House for use by its residents, who may wish to residents, who may wish to prepare light meals, snacks, etc. (Please note that the meal plan remains compulsory to all students living in residence.

There are no facilities on campus for married students. Graduate students wishing to apply to live in residence should make inquiries to the office of the Faculty of Graduate Studies.

### Off-Campus Housing

Telephone: 520-5614

The Off-Campus Housing Service is designed to provide assistance in finding suitable accommodation to students who cannot be accommodated on campus or who are interested in off-campus housing. This service mainly operates on a self-help basis, with listings of accommodation posted outside 261

Stormont House for viewing 24 hours per day, seven days a week. During normal office hours, staff members are pleased to assist with information, advice, etc. In addition, the Off Campus Centre, located in 211 Residence Commons Building, operates from 9:00 a.m. - 4:00 p.m. during the months of July and August. Staff of the Centre provide personal assistance and further information.

Details regarding each listing include rates and amenities provided. The University does not undertake to inspect or approve any of the facilities listed, so it is strongly advised that the search be undertaken in person. The listings can also be viewed on any terminal having access to the University mainframe by typing the word HOUSING after the "enter class" prompt appears.

In addition, a newsletter titled "Faculty and Staff Listing" is published on the 15th of every month. (Deadline for submissions is the 13th.) This lists accommodations of staff members going on sabbatical leave for periods ranging from four months to two years. Lists are distributed to each department on campus and are available on request.

### Food Services

Telephone: 520-5612

Beaver Foods: 520-5618

A-la-carte food service is available in eight locations across campus:

The Food Court, offering Mr. Submarine, Taco Bell, Harvey's, Market Grill and Domino's Pizza, second level, University Centre; The Second Cup, first level, University Centre; Rooster's Wing, fourth level, University Centre; The Loeb Cafe, first level, Loeb Building; Junction Second Cup, Library precinct, Tunnel level; The Oasis Cafeteria, first level, Residence Commons; The Bent Coin, fifth level, Robertson Hall

In addition, "all-you-care-to-eat" lunch and dinner is available in the Residence Dining Halls, third level Residence Commons for the price of admission. Students with Campus Cash plans are entitled to reduced prices and tax exemption where permitted.

Vending machines provide off-hour service. Students with Campus Cash plans can make cash purchases without using cash from many of these machines.

A variety of "Campus Cash" plans are available to students offering savings on campus food purchases through both discounts and tax exemptions.

"Care Packages" provide an easy means for friends and families to send birthday cakes,

## Student Services

exam study snacks, or celebrate other special occasions with a food treat.

The catering division of food services is equipped to provide banquet services, receptions, party trays or beverage service for groups of up to 800 guests.

### Tour and Conference Centre

Telephone: 520-5611

Fax: 520-3952

Each year from May to August, the Housing and Food Services Department operates a successful Tour and Conference Centre. Residence facilities accommodate up to 1,400 guests. A wide range of services including accommodation, catering, meeting rooms, lecture theatres, all at very reasonable rates, are available to conferences and tour groups.

Accommodation is also available to short-term summer visitors from the single traveler staying only one night to students and their families who wish to attend or participate in such University functions as Convocation and first-year student Welcome programs. Long term summer residence (four to six weeks) can be reserved in conjunction with one of four available meal plans.

Arrangements for special functions such as wedding receptions, banquets, parties (large and small) and meetings or other special events are also co-ordinated by the Tour and Conference Centre. Such events may be booked throughout the year.

For further information please contact the Tour and Conference Centre.

## Library

MacOdrum Library

Telephone: 520-5621 (hours recording)

520-2735 (Reference and Information)

Fax: 520-2750

Web site: <http://www.library.carleton.ca/>

Email: [university\\_librarian@carleton.ca](mailto:university_librarian@carleton.ca)

### Senior Staff

*University Librarian*

Martin Foss

*Associate Librarians*

Terry Sulymko (Systems and Technical Services)

Linda Rossman (Information Services)

*Department Heads*

Gail Catley (Acquisitions)

Bozena Clarke (Access Services)

Alison Hall (Cataloguing)

Anita Hui (Collections)

Susan Jackson (Maps, Data, and Government Information)

Callista Kelly (Interlibrary Loans)

Elizabeth Knight (Reference Services)

Dorothy Rogers (Gifts)

### Collection

The University Library, located on the south-west side of the main quadrangle, provides access to a wide variety of materials in support of teaching, learning, and research activity at Carleton. The collection includes more than three million books, periodicals, government documents, maps, newspapers, musical scores, compact discs, microforms, archives and rare books. To locate material in the system, you must consult CUBE, the Library's online catalogue. Access to electronic resources is provided through CD-ROM databases, the Internet, and an online literature search service. Increasingly, more materials are acquired through various commercial document delivery services.

### Borrower Information

Books may be borrowed at the Circulation Desk or by using the self-check machine located on the Main floor of the Library. You must have a validated ID card with a barcode or Patron Number in order to borrow. Users of the self-check machine must also know their Personal Access Code. Items, with the exception of reserve materials, circulate for two weeks to undergraduate students, and for four weeks to fourth year honours students, graduate students, faculty and staff. On payment of an appropriate fee, alumni of Carleton University and the general public may purchase an outside borrower's card which entitles the holder to limited borrowing privileges.

The Library participates in the Ontario Council of University Libraries (OCUL) Resource Sharing Agreement. This permits all students, faculty, and staff with a valid Carleton ID card, to register at participating Ontario libraries in order to borrow material directly. The Library also participates in IUBP (Inter-University Borrowing Program), which allows Carleton students to borrow from Quebec universities. The Center for Research Libraries offers students access to its material through the Interlibrary Loans Department. As part of a reciprocal borrowing agreement with the University of Ottawa, students, faculty, and staff of Carleton University are given limited borrowing privileges at the University of Ottawa Libraries.

### Regulations

The Library is governed by Senate-approved regulations. The collection is protected against theft by an electronic book detection system. If requested, Library borrowers must submit books, briefcases, and bags for inspection at the Stacks Services Desk. Late return fines and



billing costs are charged for overdue books. Borrowers with three overdue books will have their privileges automatically suspended until all items are returned. Examination grades and transcripts will be withheld from students who owe money to the University.

### Specialized Collections

#### *CBC Newsworld*

The CBC Newsworld Collection is an archival and research collection of videotaped programs housed in Room 402.

### Maps, Data, and Government Information Centre

#### *Maps*

The Map collection consists of print, microform, and digital cartographic resources covering Canada and the world. These include topographic and thematic maps, as well as atlases, wall maps, gazetteers, and air photographs.

#### *Data Centre*

The Data Centre is a depository for machine-readable social sciences data and a resource to facilitate data analyses.

#### *Government Documents*

The Documents collection has print, microform, and electronic publications issued by governments at every level, including international, intergovernmental organizations. The collection is particularly strong in Canadian federal and provincial documents, and publications of international agencies.

#### *Special Collections and Archives*

Some print and manuscript materials, because of the content, format, age or value, must be preserved and kept apart from the general collection. This material, as well as the Carleton University Historical Collection and the Library Archives, is housed in Room 503.

### Specialized Services

#### *Interlibrary Loans*

If the Library does not have the materials you need, you may request that they be borrowed from another library. Books are usually loaned free of charge; charges may apply for periodical articles provided through conventional I.L.L. or through commercial document delivery services.

#### *Joy Maclaren Adaptive Technology Centre*

The Adaptive Technology Centre, located in Room 232, is equipped with adaptive equipment for use by students with disabilities who are registered with the Paul Menton Centre. Wheelchair accessible CUBE terminals, equipped with large monitor, are available through the Library.

#### *Orientation*

General tours, CUBE instruction, specialized course seminars and workshops are offered by staff from Reference Services and the Maps, Data, and Government Information Centre. The Library maintains a computer-equipped training centre in Room 102 for instruction in the use of CUBE and other electronic information sources.

#### *Research Assistance*

Reference Services staff will assist clients in finding library materials, researching essay topics, and identifying the best resources to consult for information needs.

### Ombuds Services

511 University Centre

Telephone: 520-6617

Jim Kennelly

University Ombudsperson

Ombuds Services deals with a variety of grievances and complaints as well as with requests for information. A few examples of the on-campus and off-campus problems include academic appeals, graduation appeals, fee disputes and human rights issues. Financing of this service is provided equally by the University and the Students' Association (CUSA).

### Paul Menton Centre for Persons with Disabilities

500 University Centre

Telephone: 520-6608

TDD: 520-3937

Fax: 520-3995

Website: [www.carleton.ca/pmc](http://www.carleton.ca/pmc)

Larry McCloskey - Associate Director, Student Life Services, responsible for the Paul Menton Centre

Nancy McIntyre - Learning Specialist / Coordinator, Learning Disabilities

Diane Proulx - Learning Specialist / Coordinator, Physical Disability Programs

Matthew Cole - Co-ordinator, Attendant Services

#### **Academic Accommodation**

Carleton University has a Senate-approved policy on Academic Accommodation (see p. 51). This policy promotes reasonable efforts to accommodate students with disabilities so that they will have the opportunity to meet learning objectives and be fairly evaluated in their performance. The University is strongly committed to providing reasonable access and reasonable accommodation for all individuals with identified and duly assessed disabilities.

ties. In no case, however, does academic accommodation negotiate away, lower or remove the academic standards and learning objectives of any course or program at the University.

### Publications

A series of brochures and flyers on resources and services available to students with disabilities at Carleton University may be obtained from the Paul Menton Centre free of charge. Information is also available on the website.

### Requests for Service

The Paul Menton Centre provides individualized support services, based on appropriate and up to date documentation, to persons who are deaf or hard of hearing, with learning disabilities, attention deficit disorder (ADD), visual impairments, head injuries, physical disabilities including mobility impairments, or who have psychiatric or other medical disabilities. The Centre accommodates as many requests as resources permit.

Students are responsible for applying for special services by making an appointment with the appropriate coordinator. All requests will be considered on an individual needs basis. Students are advised to come to the Centre early in the term to discuss service requests.

### Examination Accommodations

Examination accommodations for all tests and examinations (in-class, itv, or formally scheduled) must be arranged by specific deadline dates. Please refer to the Paul Menton Centre for a list of deadlines for all examinations. Accommodation requests not made prior to the specified deadlines will not be fulfilled.

### Library Services for Students with Disabilities

Students referred by the Paul Menton Centre have access to the Joy MacLaren Adaptive Technology Centre, located on the main floor of the MacOdrum Library, Room 232. Heather Cross, Coordinator of Library Services for Students with Disabilities, is located in the department of Reference Services, Room 206 (520-2600, extension 8186). Students are advised to contact her for a complete list of services available in the Library including use of the Centre, research assistance, stacks retrieval, assistance with photocopying, and reserves assistance. Services at the University of Ottawa for students with disabilities are also available to Carleton students. Students must obtain a letter of referral from Heather Cross for each academic year to have access to services at the University of Ottawa.

The Joy MacLaren Adaptive Technology Cen-

tre has six workstations on which students have access to various software applications (word processing and spreadsheets), SS-Labs, CUBE, Chat Accounts, the Campus Network, large screen monitors, adjustable-height computer tables, a voice recognition system, screen magnification, screen reading and a scanner.

The Library's contact for transcription services is Margaret McLeod of the department of Reference Services (520-2600, extension 8943). Students referred by the Paul Menton Centre are registered with the W. Ross MacDonald School, the provincial agency which provides texts and other course related material in alternative formats for students with a print disability. For tapes that must be borrowed from Recordings for the Blind and Dyslexic, there is a lifetime registration fee of \$75 (U.S.) plus a \$25 (U.S.) annual fee. It is essential to obtain course outlines as early as possible, and to get your requests in early.

Students may scan text using the Reading Edge, a reading machine, and have the scanned material recorded onto audio tape or downloaded onto a disk. This machine is housed in the Joy MacLaren Adaptive Technology Centre.

### Assistive Technical Devices

A limited number of portable computers, two and four-track tape recorders, and personal FM systems are available for loan. Written referral by a Paul Menton Centre Coordinator is required.

### Students who are Deaf or Hard of Hearing

It is the student's responsibility to initiate early enquiries. If specialized equipment or services, such as personal FM systems or sign language interpreters, are required, please contact the Centre at least a month prior to the start of classes. The Centre acts as liaison for agencies which may provide funding for various services. Early enquiries are required to arrange these services.

### Students with Learning Disabilities

It is required that the student have a recent psychoeducational assessment available which has been administered after the age of 16 or within three years of initial registration at the Paul Menton Centre. This will allow Paul Menton Centre staff to organize services that address each individual's particular learning disability.

### Students with Attention Deficit Disorder (ADD)

To receive accommodation, students with ADD are required to have formal identification from a psychiatrist, psychologist or physician. For further information contact the Paul Menton Centre.

### Students with Mobility Impairments

The campus of Carleton University is well equipped for accommodating persons with physical disabilities. The buildings are in close proximity to each other and most are connected by tunnels. All of the main buildings have elevators and are ramped for outside entrance and egress. Most sidewalks have been made accessible by curb-cut renovations. A building-by-building accessibility inventory is available from the Centre or on the website.

### Students with Non-Visible Disabilities

Students with non-visible disabilities may have legitimate needs which are not easily recognized or understood within the University community. Students with psychiatric or medical disabilities may wish to contact the Paul Menton Centre to discuss personal or academic issues of concern to them. Appropriate documentation is required.

### Attendant Services Program in Residence for Students with Disabilities

The Attendant Services Program in Residence offers 24 hour assistance with activities of daily living such as personal care, room chores, cafeteria assistance, etc. The program is available to students with various levels of disability and attempts to respond to individuals according to their specific needs. In order to provide comprehensive services only a limited number of program spaces are available each year. A guide describing the program in detail is available free of charge by contacting the Attendant Services Co-ordinator at 520-6615.

For students who need an accessible room in residence but do not require attendant services, a limited number of rooms are available based on the following criteria: the need for special accommodation, level of disability, whether the applicant has housing alternatives in the area, and the date of application. For further information contact the Accommodations Officer in the Department of Housing and Food Services at 520-5612.

### Student Life Services

501 University Centre  
Telephone: 520-6600  
Fax: 520-3995  
Website: [www.carleton.ca/studentlife](http://www.carleton.ca/studentlife)

Student Life Services offers a wide range of programs and services to assist students in their adjustment to academic life, in improving their learning strategies, and in making decisions with regard to academic and career concerns.

### Campus Life Program

The main goals of campus life programming is to assist new students in a variety of areas (e.g., academic, social, emotional, leadership) thereby easing the transition to life at Carleton University. In addition to orientation activities, services and programs are offered throughout the year to introduce students to the many resources available on campus and to get students involved. The Campus Life Coordinator is available to discuss concerns specific to graduate students.

### Study Skills Program

The Study Skills Program is designed to assist both undergraduate and graduate students. A series of workshops, which begin in early September, cover topics such as Active Reading, Essay Writing, Oral Presentations as well as general Study Skills workshops covering Note-taking, Time Management and Exam Preparation. These are offered in small groups to accommodate discussion and interaction, and participants have access to individual follow-up if needed. Drop by to register in advance for the workshops.

For individual assistance in a specific area (e.g., coping with graduate studies), see a Study Skills Specialist during drop-in hours. Free brochures on topics such as Time Management, Active Reading, Note-taking, Exam Preparation, and Study Skills for itv students are available. A variety of study skills videotapes are also available through Instructional Media Services.

### International Student Advisory

The International Student Advisor is available to discuss particular concerns international students may have. An orientation program is held every August and January for incoming international students. Information and assistance concerning university education, financial assistance, health coverage UHIP, immigration regulations, and the general adjustment to a new living situation are available. Please call for drop-in and appointment times.

Student Life Services is also responsible for Career Services (see p. 16) and the Paul Menton Centre for Persons with Disabilities (see p. 23).

### University Centre

The University Centre (Unicentre) is a non-academic, student-oriented building which serves as the hub of the campus. It is home to the Carleton University Students' Association and virtually all of its operations (i.e. coffeehouse, pub, convenience store). Its location and atmosphere makes it the perfect meeting place and an ideal setting for events of interest to all students.

## **Student Services**

In addition to housing CUSA services, the Unicentre is home to: Student Life Services, Information Carleton, Ombuds Services, the Graduate Students' Association, a division of the Ontario Public Information Research Group, and the Paul Menton Centre. Porter Hall, which is available for both on- and off-campus groups to rent, is also located within the Unicentre.

For a more complete list of the services available, please see the section entitled Carleton University Students' Association. (See p. 17)

### **Writing Tutorial Service**

The Writing Tutorial Service offers individual and small group tutorials to students who want advice on the writing of university essays. The tutors provide practical instruction on all aspects of the writing process from the initial research and data-gathering, to the exploration and organization of ideas, through to the final preparation of the manuscript. In addition, the service regularly presents workshops on style and the general principles of essay writing at the request of Faculty and/or Teaching Assistants. The service is offered free of charge to all Carleton students, part-time and full-time, graduate and undergraduate. For an appointment or information, call 520-6632 or visit 215 Paterson Hall from 9:00 a.m. to 4:00 p.m., Monday to Friday.



## Alumni Association

510 Robertson Hall

Telephone: 520-3636

Fax: 520-3587

E-mail: [devalum@carleton.ca](mailto:devalum@carleton.ca)

Web address: <http://www.carleton.ca/alumni>

The Carleton University Alumni Association represents the over 75,000 graduates of Carleton University. Membership is automatically extended to all graduates, and is available, upon request, to former students who have completed 5.0 credits but are no longer registered at Carleton.

The objectives of the association are to advance the excellence and prestige of Carleton University as a distinguished institution of higher learning in Canada, and to encourage a spirit of loyalty, friendship, service and benevolence among the members.

The alumni association serves the University by promoting its well-being through contact with graduates, government, the public, faculty, students and potential students. Its members are actively involved in various advisory boards and recruiting activities. It is governed by the National Alumni Council, a volunteer group comprised of branch and chapter representatives and committee chairs.

All graduates with known addresses receive the Carleton University Magazine three times per year. The Department of Development and Alumni Services maintains alumni records to ensure a meaningful and continuing dialogue between alumni and the University.

The alumni association sponsors Homecoming, reunions, an alumni awards program, and various branch and chapter activities. The association offers services to alumni including life, automobile and home insurance, an affinity MasterCard and diploma framing.

Funds from alumni help to support student awards and other specific projects.

Executive Members of the National Alumni Council for 1999-2000 are:

Jennifer Higgins-Ingham, BA/89, BAHons/92, *President*

Maria McClintock, BA/86, *Vice-President, Membership/Operations*

Patrick O'Reilly, BCom/92, *Vice-President, Policy*

Michael Makin, BJ/86, *Past-President*



## **Inventions, Technology Transfer, Intellectual Property and the Graduate Student**

Technology and Research  
Development Office  
1524 Dunton Tower  
Telephone: 520-2517  
Fax: 520-2521

In the course of their research activities, graduate students at Carleton University sometimes make discoveries that have commercial potential. There is a process that enables inventors at Carleton University to seek protection for their ideas and to enter partnerships to seek commercial possibilities.

As soon as preliminary research results exist or when outsiders have expressed interest in your research area or technology, graduate students should contact the Technology and Research Development Office. This office identifies, evaluates, and protects the inventions and technologies developed on campus. It also assists in the transfer of these technologies to the private sector. If you have any questions regarding intellectual property, patents, confidentiality agreements, etc., please contact the Technology and Research Development Office or visit their Web page at <http://www.gs.carleton.ca/trdo>.

## **Student Participation in Academic Affairs**

There are several ways in which students may become involved in academic issues on campus.

Students may join the New University Government (NUG). NUG is an organization which gives students direct input into academic decisions by filling the student representative positions at departmental meetings. As a result of such representation, students have direct input into curriculum committees and hiring boards, as well as routine departmental issues. Each department has at least one graduate NUG representative. Departmental NUG representatives also sit on their (specific/respective) Faculty Boards. Each faculty is entitled to send two representatives to the Graduate Faculty Board, and two of these student representatives are elected to the University Senate where most of the general academic decisions are made.

There are several Senate policy committees which have graduate student representation. These include the Library, Computer, Admission and Studies, University Government, and the Academic Planning committees. There are other Senate committees, but to date they do not have spaces reserved specifically for graduate students.

Finally, there is the GSA council, where representatives from every department meet not only to discuss academic issues but to formulate GSA policies on academic matters, which may be presented to the Senate or other University committees.

To obtain more information on any of these, please call the GSA at 520-6616, or drop by the office, 600 Unicentre.

## Carleton International

K.J. McGillivray  
Director

Dunton Tower 1506

Telephone: 520-2519

Fax: 520-2521

E-mail: [ken\\_mcgillivray@carleton.ca](mailto:ken_mcgillivray@carleton.ca)

Website: <http://www.ci.carleton.ca>

Carleton International co-ordinates the University's efforts in international activities. Carleton has many formal academic linkages with other countries. These are administered on behalf of the University by Carleton International, and many allow graduate students to spend a term or a year abroad in study relating to their research. Information and applications to participate in an exchange as well as information on scholarships and study/ work opportunities abroad are available through Carleton International. Application is usually made in October/November.

Carleton International is also responsible for the negotiation, management and administration of international grants and contracts, liaison with the international and diplomatic community and for the reception of foreign visitors and delegations to the University.

## Study Abroad

Carleton has many formal academic linkages with other countries. These are administered on behalf of the University by Carleton International. Students have the opportunity to spend a term or a year abroad in such countries as Australia, Austria, Cuba, England, Germany, France, Hungary, Jordan, Japan, Mexico, Poland, Russia, Tanzania, and Scotland. Application forms and scholarship information for study abroad are available through Carleton International, Room 1506, Dunton Tower, telephone 520-2519. Application deadline is usually late November.

## Fees

### Tuition Fees and Charges 1999-2000

Tuition fees, late charges, and other fees and charges are reviewed in the spring of each year. At the time of printing, tuition fees and charges for 1999-2000 were not yet decided upon.

Once fees and charges have been set, specific details will be published on Carleton's website by May 1 (<http://www.carleton.ca/fees/>) and in the *Registration Instructions and Class Schedule* booklet which is made available to all incoming and returning students during the month of July. Students are advised to familiarize themselves with this information.

### Dates Relating to Fees and Charges

Dates relating to tuition fee payments, cancellations of course selections, late charges, and other fees or charges are published in the Important Dates and Deadlines section of the 1999-2000 *Registration Instructions and Class Schedule* booklet.

## Awards and Financial Assistance

### General Information

#### Medals

\* The Governor General's Medal, Graduate Level

Awarded annually to a graduating student of very high academic standing in a master's or doctoral program of study. Donor: His Excellency the Governor General of Canada. Established in 1988.

\* University Medal at the Ph.D. Level

Awarded at each convocation ceremony, when merited, to a graduating student for outstanding academic achievement at the Ph.D. level. Established in 1982.

\* University Medal at the Master's Level

Awarded at each convocation ceremony, when merited, to a graduating student for outstanding academic achievement at the master's level. Established in 1982.

### Awards Policy

In recent years Carleton graduate students have won a large number of external scholarships, such as SSHRC fellowships, NSERC scholarships, and Ontario Graduate Scholarships. In addition, the University itself provides generous support, and the majority of graduate students receive funds from this source.

Students who hold such awards must pay regular tuition fees unless otherwise stated.

Full-time graduate students at Carleton University are expected to comply with the following procedure. Any full-time graduate student who accepts an award that is not directly administered by Carleton University must immediately inform his/her departmental chair and the Dean of the Faculty of Graduate Studies and Research in writing. This requirement applies to any awards or assistance offered by any agency or institution.

### Application Deadlines

March 1 is the last date for receipt of completed applications for admission (including transcripts, letters of reference, etc.) from candidates who wish to be considered for the initial award, announced April 1, of financial assistance administered by Carleton University. However, some departments have earlier application deadlines and students are strongly advised to check with the individual department concerned.

Candidates whose applications are received after the March 1 deadline may be eligible for the award of a scholarship and assistantship by reversion.

### Method of Payment

All awards administered by Carleton University will be paid on a monthly basis, with the first installment on September 30.

*Students are urged to note the above payment dates and be prepared to be financially self-sufficient during the month of September.*

### Other Awards

A number of national and provincial organizations award fellowships and scholarships which are tenable at Carleton University (for example, SSHRC, OGS, NSERC, etc.). Some application procedures and regulations concerning fellowships awarded by agencies other than Carleton University are given in the description of each of these awards.

In addition, a large number of foundations, companies, fraternal organizations, and other agencies offer fellowships and scholarships.

The Faculty of Graduate Studies and Research maintains an information system to assist the Carleton community in identifying funding opportunities for graduate studies. The information system is available at the Web site: <http://www.carleton.ca> and contains information on agency deadlines and the application procedures.

### Eligibility

In the case of fellowships, grants, scholarships, etc., for which students must make application, it is the individual student's responsibility to establish his/her eligibility. Should it become known that a student is unqualified for any reason, he/she must return the funds already received, with the University assuming no responsibility.

Departments recommending students for internal awards must accept full responsibility for the eligibility of their nominees.

Students are urged to consult carefully the brochures and announcements which specify the conditions associated with tenure of individual awards.

This information is available in the office of the Faculty of Graduate Studies and Research and in departmental offices.



### Awards Administered by Carleton University

The awards administered by Carleton University are derived from a variety of sources. Throughout the years, a number of individuals and organizations

have contributed substantial funds to the University, through bequests and donations, in order to help support students in various fields of study.

It is not always possible to identify precisely the sources of various donations and bequests (often small, but most important in the aggregate) from which any graduate student's financial support has been constructed.

These sums, together with the assistantship funds made available from the University budget, make up the reservoir from which the Carleton scholarships and assistantships are drawn.

In the following cases, however, either because of the relative importance of the contribution or because of the fact that it is earmarked for a specific type of student or program, we do identify the external source from which the award has originated.

### Carl Amberg Fund for International Students

To be awarded annually, on the recommendation of the Dean of Graduate Studies and Research, to an international graduate student in financial need. Endowed in 1997 by Carl Amberg, a former Dean of Graduate Studies and Research whose distinguished career at Carleton was cut short by a sudden stroke in 1980. Duncan M. Anderson Memorial Bursary

This bursary was endowed in 1992 by colleagues, former students, and friends of Duncan M. Anderson, who was a professor in the Department of Geography from 1964 to 1992. It is awarded annually to a deserving full-time student enrolled in the graduate program in geography who is in need of financial assistance, and whose studies relate to land use planning, resource management, or geographic aspects of the environment.

Application is not required. The name of the recipient will be announced by the Dean of the Faculty of Graduate Studies and Research, on the recommendation of the Chair of the Department of Geography.

### Friends of Art History Book Award

Endowed in 1994 by the Friends of Art History, this award, valued at \$100, is presented annually to a graduate student enrolled in the

Master of Arts program in Canadian Art History. Application is not required. The recipient will be chosen on the recommendation of the Art History Graduate Committee.

### The Association of Palestinian Arab Canadians Graduate Scholarship

This scholarship was established in 1988. It is awarded annually to an outstanding recent graduate of the following Palestinian universities: Bier Zeit, Al-Najah National, Al-Khaleel (Hebron), Bethlehem, The Islamic University of Gaza and Al-Quds (Jerusalem).

The recipient will be chosen by an awards committee chaired by the Dean of the Faculty of Graduate Studies and Research from nominations made by the students' home institutions. It is hoped that the recipient will return to a teaching position in a Palestinian University.

### Auto-Carto Six Scholarship

This scholarship is awarded annually to a graduate student in geography studying computer-assisted cartography. The scholarship will be awarded, on the recommendation of the Department of Geography, on the basis of academic merit as determined by the academic index used by the Faculty of Graduate Studies and Research.

### Walter Baker Fellowship

In honour of the distinguished contribution of the late Walter Baker to Canadian politics, parliamentary life, and public administration, and his long-standing dedication and service to the Ottawa community, Minto Construction Ltd. has established the Walter Baker Fellowship. It is awarded annually to an outstanding student entering the School of Canadian Studies M.A. program. Application is not required; the recipient will be chosen by the graduate awards committee from a list of candidates recommended by the Director of the School of Canadian Studies.

### Fred Barkley Special Bursary

This bursary, in the amount of \$500, is awarded annually to a graduate student from a developing country who requires special financial assistance in order to study at Carleton University. The recipient of the award will be announced by the Dean of the Faculty of Graduate Studies and Research each year.

### Harold Bernstein Memorial Award in Physical Chemistry

This grant, valued at approximately \$1,000, will be awarded annually to a student joining the graduate program of the Ottawa-Carleton In-



stitute to study and do research in the area of physical chemistry. It is a one-time scholarship, and is additional to all other stipends or scholarships that the student may hold.

The award is named in honour of Dr. Harold J. Bernstein, eminent spectroscopist and researcher, who retired from the National Research Council, Ottawa, in 1979. Dr. Bernstein served as an adjunct professor of chemistry at Carleton University from 1970 to 1979.

#### **Dr. Thomas Betz Memorial Award**

Established in 1990 by family, friends, and colleagues in memory of Dr. Thomas Betz, this award, valued at \$1,000, is open to undergraduate and graduate students, and is awarded annually, when merited, on the basis of scholarly promise and potential for intellectual leadership. The recipient will be chosen on the recommendation of a selection committee chaired by the Dean of the Faculty of Graduate Studies and Research, from a list of candidates nominated by departments, schools, and institutes.

#### **Board of Governors' Graduate Student Bursaries**

Established in 1992 by members and friends of Carleton University's Board of Governors on the occasion of Carleton University's 50th Anniversary, these bursaries are available to graduate students who are Canadian citizens and who need financial assistance to cover tuition fees.

Application should be made to the chair/director of the student's academic unit. The final selections will be made by the Dean of the Faculty of Graduate Studies and Research from a list of names recommended by each academic unit.

#### **The Swithun Bowers Memorial Social Work Bursary**

Endowed in 1985, this bursary is available to graduate students within the School of Social Work who are nearing the completion of their program and experiencing financial difficulty in meeting the costs of typing/reproduction of their thesis or independent enquiry project.

The selection of the recipient(s) will be decided on the recommendation of the Director of the School of Social Work.

#### **Peter Browne Memorial Scholarship Fund**

This scholarship was established in 1983 by students, friends, and colleagues of the late Professor G. Peter Browne. The recipient will be chosen by the awards committee upon the recommendation of the Department of History from among those students who apply.

Preference will be given to deserving history graduate students who are nearing the completion of their thesis.

#### **Building Envelope Council, Ottawa Region, Award**

Valued at \$200 and established in 1995, this awarded is given annually, on the recommendation of the Chair of the Department of Civil and Environmental Engineering, to a graduating student in an undergraduate or graduate program of study who has demonstrated excellence in the area of building envelopes.

#### **Dr. John Davis Burton Award**

Awarded annually, when merited, to a student in good standing enrolled in a program at Carleton University, University of Ottawa, La Cite Collegiale, or Algonquin College who has made a significant contribution toward awareness, equality, and integration of persons with disabilities within his/her educational community. The recipient will be chosen on the recommendation of the Assistant Director (Special Needs), Student Life Services at Carleton University, assisted by a Selection Committee. Endowed in 1992 by students, family, and friends of Dr. John David Burton, who was a champion and advocate for persons with disabilities throughout his career as an educator.

#### **CAL Corporation Scholarship**

This scholarship, valued at \$2,500, is provided annually by CAL Corporation in honour and memory of Mr. Bev Christie, Mechanical Group Leader, who was a key employee at CAL Corporation until his untimely passing. It is awarded to a student of outstanding performance studying for a graduate degree in electrical engineering who is working in the field of aerospace electronics with an emphasis on microwave technology, antennas, or radar.

Application is not required. The recipient will be selected on the recommendation of the Scholarship Committee, composed of the chair of the department, one other faculty member, and a representative from CAL Corporation. The recipient of the award will be announced in January each year. In a given year, the award may not be made for lack of a suitable candidate, but will be held over so as to allow more than one recipient in a subsequent year.

### **Canadian Marconi Company Bursary in Electrical Engineering**

This bursary, established in 1987 by Canadian Marconi Company, is available to graduate students in Electrical Engineering who are in need of financial assistance.

Application should be made to the Faculty of Graduate Studies and Research. The recipient will be selected each year by the Dean of the Faculty of Graduate Studies and Research.

### **Canadian Marconi Company Scholarship in Electrical Engineering**

This scholarship, valued at \$1,000, is awarded annually, on the basis of academic achievement and on the recommendation of the Dean of Engineering, to a student enrolled in a graduate program in electrical engineering who is working in the area of analog electronic design, antennas and prorogation, power systems, or microwave theory.

### **CHEZ-FM Inc. Research Award in Sociology**

This award, valued at \$600, was established in 1989 by CHEZ-FM Inc. to assist with the cost of a media-related research project, essay, or thesis involving quantitative research on radio broadcasting or broadcast regulation generally, or contributing to general theoretical development in media sociology. It is awarded annually, when merited, to a fourth-year honours student or a graduate student enrolled in a sociology program.

Application is not required. The recipient will be announced by the Dean of the Faculty of Graduate Studies and Research, on the recommendation of a selection committee comprised of the Chair of the Department of Sociology and Anthropology, the Coordinator of the Honours Program (Sociology), the Coordinator of the Graduate Program (Sociology), and a representative from CHEZ-FM Inc.

### **R.F. Chinnick Memorial Scholarship**

This scholarship is provided by Telesat Canada in memory of R.F. Chinnick, their former Vice-President of engineering and operations. It is awarded annually, where appropriate, to a student enrolled in a graduate program in electrical engineering who is working in the field of satellite communications, or whose work has direct relevance to this area of telecommunications.

It is normally awarded in the second or subsequent year of graduate work, when the student's area of specialization has been well established. It may be awarded more than once

to the same student. If an award is not appropriate in a given year, it will be held over so as to allow more than one recipient in a subsequent year.

### **The Irene Ethel Cockburn Bursary**

This bursary, which carries a value of up to \$2,000, was established in 1991 and is derived from a legacy of the late Irene Ethel Cockburn. It may be awarded to one or more graduate students who require special financial assistance in order to complete their studies at Carleton University. Application is not required. The recipient(s) will be selected by the Dean of the Faculty of Graduate Studies and Research from a list of candidates recommended by each department.

### **Scholarship in Comparative Economics**

Awarded annually, if merited, on the recommendation of the Chair of the Department of Economics, to a graduate or undergraduate student who has shown aptitude in the field of comparative economics. Endowed in 1991 by Professor Richard Carson in memory of his parents, Robert L. and LeVerne N. Carson.

### **Odette Condemine Graduate Scholarship in French Canadian Literature**

Endowed in 1995 by Professor Odette Condemine, who taught French Canadian Literature at Carleton University until her retirement in 1992, this scholarship is awarded annually, when merited, to the graduate student in the French program who has demonstrated the most promise in French Canadian Literature. Application is not required. The recipient will be announced by the Dean of the Faculty of Graduate Studies and Research on the recommendation of the Chair of the Department of French.

### **Helen and Joe Connolly Bursary**

To be awarded annually to a deserving graduate student in Canadian history in need of financial assistance. Consideration for the award will be given on the basis of academic achievement combined with an interest in community involvement and extracurricular activities. Endowed in 1997 by Helen and Joe Connolly. The recipient will be selected by the Chair of the Department of History.

### **Davidson Dunton Memorial Student Assistance Fund**

Established in 1987 by relatives, colleagues, and friends of the late Davidson Dunton, Carleton's fourth and longest serving President and a Director of the School of Canadian Studies, this fund is available to graduate stu-

dents within the School of Canadian Studies who are experiencing financial difficulty meeting the costs of typing/reproduction of their thesis or other research papers, attendance at conferences, or other approved special needs.

The selection of the recipient(s) will be made upon the recommendation of the Director of the School of Canadian Studies.

### **Rachael Elizabeth Edwards Memorial Award**

Awarded annually, on the recommendation of the School of Journalism and Communication, to an outstanding student completing the first year of the Master of Journalism program. Preference will be given to a female student who has indicated an interest in pursuing a career in the daily newspaper field.

Endowed in 1974 in memory of Rachael Elizabeth Edwards, a former student in the School of Journalism and Communication. Revised in 1987.

### **The Hendrika Alice Eisen Memorial Fund**

This fund was established in 1990 by friends, co-workers, and relatives of the late Hendrika Alice Eisen, a graduate student in the Department of Psychology who was working in the interdisciplinary area of computer interface design.

In memory of the interdisciplinary nature of her interests and the high regard she had for the annual conference in computer-human interactions (CHI) presented by the Special Interest Group SIGCHI of the Association of Computing Machinery, this fund is to assist graduate students interested in attending this annual conference. Application for assistance with travel or accommodations can be made to the office of the Faculty of Graduate Studies and Research. Preference will be given to students presenting posters or papers at CHI and who are acting as student volunteers at the conference. The award is open to students from any discipline who are interested in attending the CHI conference.

### **The David and Rachel Epstein Foundation Fellowship: Equal Pay for Work of Equal Value**

Established in 1985, this fellowship is open to students studying in any discipline within the social sciences or humanities to support a master's or doctoral student in a thesis program. The thesis should be on the topic of "equal pay for work of equal value", and should have a strong empirical basis with application to Canadian work settings.

Valued at \$6,000, this fellowship is provided by part of the income from the David and Rachel Epstein Fund. It will be awarded on the basis of academic merit as determined by the Faculty of Graduate Studies and Research from a selection of applicants who have submitted a research proposal related to the above. Departments will be asked by the selection committee to nominate suitable candidates. Deadline for the completion is February 1. In a given year, the award may not be made for lack of a suitable candidate.

### **David and Rachel Epstein Foundation Scholarships**

Part of the income from the David and Rachel Epstein Foundation Fund, which was established in 1970, has been designated to provide scholarships for outstanding graduate students at Carleton University.

Up to twenty scholarships valued at \$1,000 will be awarded annually to students from a list of candidates recommended by each department. Application is not required.

### **Harriet and Eugene Forsey Scholarship**

This scholarship was established in 1993 by the Canadian Federation of University Women/Ottawa in memory of the mutual fidelity of the Forseys. Senator Eugene Forsey was a recognized expert on the Canadian Constitution and a lecturer in Carleton's Political Science Department for many years.

Valued at \$1000, this scholarship is awarded annually, when merited, to a graduate student in the Political Science program who is working in the area of the Canadian Constitution. Application is not required. The recipient will be announced by the Dean of the Faculty of Graduate Studies and Research, on the recommendation of the Chair of the Department of Political Science.

### **GAC-MAC Graduate Scholarship in Earth Sciences**

This scholarship was endowed by the Geological Association of Canada and the Mineralogical Association of Canada in recognition of the support provided by the Ottawa-Carleton Geoscience Centre when Carleton University hosted the "Ottawa 86" Annual GAC-MAC Meeting.

It will be awarded annually to a graduate student enrolled in the Ottawa-Carleton Geoscience Centre. Application is not required. The recipient will be selected by the Board of Management of the Ottawa-Carleton Geoscience Centre.



### **Indira Gandhi Memorial Fellowship**

This fellowship, to the value of approximately \$10,000, was established in 1985 by friends of India to honour the memory of Mrs. Indira Gandhi, Prime Minister of India, 1966-77, 1980-84.

It is awarded annually to an outstanding (preferably foreign) student enrolled in a graduate program. No application is required for this fellowship. The recipient will be chosen by an awards committee chaired by the Dean of the Faculty of Graduate Studies and Research from candidates recommended by departments, schools, and institutes having graduate programs.

### **Randall Geehan Memorial Scholarship in Quantitative Economics**

Awarded annually, on the recommendation of the Chair of the Department of Economics, to a deserving fourth-year honours student or graduate student, whose studies emphasize quantitative work in economics. Endowed in 1990 by colleagues, family, and friends in memory of Dr. Randall Geehan who was a professor in the Department of Economics.

### **Murray Goldblatt Master of Journalism Scholarship**

Awarded annually, in the amount of \$500, on the recommendation of the Director of the School of Journalism and Communication, to a student proceeding from first to second year in the Master of Journalism program, who shows the best potential as a journalist. Funded by a bequest from the estate of Murray Goldblatt, who shared his experience and passion for the media as a professor at Carleton for 19 years.

### **Lois Gonyer Bursary**

Awarded annually, on application and on the recommendation of the Director of the School of Canadian Studies, to a Canadian studies graduate student whose program is threatened because of financial need. Established in 1988 by friends and colleagues of Lois Gonyer and funded by them and institute graduates in recognition of her twenty-seven years of service as administrator in the School of Canadian Studies.

### **Graduate Scholarship in Civil Engineering**

This award is made possible by contributions from staff and faculty employees in Civil Engineering as well as from other donors. The award, valued at up to \$500, will be provided

annually to an outstanding undergraduate student at Carleton who enrolls in a graduate program in the Department of Civil and Environmental Engineering. No application is required. The recipient will be selected by a scholarship committee composed of the Chair of the Department of Civil and Environmental Engineering, the departmental supervisor of graduate studies, and two other faculty members from the Department of Civil Engineering.

### **Graduate Student Research Fund**

Application is made by letter from the graduate student to the Dean of the Faculty of Graduate Studies and Research, along with a letter of support from the supervisor. The letter should contain a brief description of the research project underway, provide a research plan outlining the need for requested funds and include a full budget. The student number should be included on the application. There is no deadline date.

The Fund is intended to cover modest research costs where other sources of support are not available. Eligible costs are: translation, questionnaire production, mailing, field travel, supplies, long-distance telephone, etc. Photocopying costs of the thesis itself are not an eligible charge against this fund. Photocopying of journal articles in a library or archive would be considered a research expense, and would be eligible for funding.

### **Graduate Student Travel Funding Policy**

The Faculty of Graduate Studies and Research provides some funding assistance to full-time graduate students who are presenting papers at scholarly conferences. Awards usually amounting to one-quarter of transportation costs are made with the expectation that, where possible, similar contributions will be made by one or more of the parent department or school, the faculty dean, the research supervisor, and the student.

Application is made by letter to the Dean of the Faculty of Graduate Studies and Research. For further information, please contact the Awards Specialist, Room 1511, Dunton Tower.

### **Rudelle Hall Memorial Scholarship**

Endowed in 1995 by family and friends in memory of Rudelle Hall, a graduate of the Master of Arts program, this scholarship is awarded annually, when merited, to a graduate student who is doing work in the area of women's studies. Preference will be given to a female student who is specializing in eco-feminism.

Application is not required. The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from a list of candidates recommended by the departments, schools, and institutes having graduate programs.

### **The Michael Hare Fellowship**

The fellowship was endowed in 1988 by colleagues, friends, and family in memory of Michael Hare, a graduate of the master's program in geography and former senior proctor in the department.

The fellowship is normally awarded annually to a student in the third or subsequent term of a graduate program in the Department of Geography. It may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be selected by the departmental graduate studies committee. The award is made on the basis of academic achievement combined with a tangible contribution to the quality of the working environment for students in the department.

### **Neil Huckvale Memorial Scholarship**

This award was established in 1981 by family, friends, and colleagues in honour of Neil Huckvale, a former graduate student in the Department of Geography. The recipient will reflect Neil Huckvale's humanity and philosophy, and will be chosen on the basis of merit and special interest in teaching and resource conservation.

The scholarship will normally be awarded annually to a student enrolled in the third or subsequent term of a graduate program in geography. It may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be selected on the recommendation of the graduate studies committee. If an award is not appropriate in a given year, it will be held over so as to allow more than one recipient in a subsequent year.

### **The Ina Hutchison Award in Geography**

Established in 1989, the fortieth anniversary of the founding of geography at Carleton, this award is presented annually. Its primary purpose is to assist graduate students in geography undertake research, but it may also be used to assist graduate students in the preparation of manuscripts for publication and to facilitate conference participation. The recipient(s) will be chosen each year on the recommendation of a Department of Geography selection committee.

### **Zbigniew A. Jordan Scholarship**

This award, established in 1978 by friends and colleagues in honour of the late Professor Zbigniew A. Jordan, is open to all graduate students in sociology.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the Department of Sociology and Anthropology on the basis of merit and special interest in sociological theory and the philosophy of social sciences.

### **The Kalmen Kaplansky Scholarship in Economic and Social Rights**

This scholarship was established in 1998 by the Douglas-Coldwell foundation in honour of the lifetime achievement of Dr. Kalmen Kaplansky, labour and human rights advocate, in the field of economic and social rights.

Awarded annually to a graduate student researching economic and social rights in a School or Department in the Faculty of Public Affairs and Management at Carleton University, the scholarship is valued at \$1,000. A detailed letter of application for the award should be made by February 1 to the Dean of Public Affairs and Management, who will select the recipient on the advice of a three-person faculty advisory committee.

### **The Eve Frankel Kassirer Memorial Scholarship**

The Eve Frankel Kassirer Memorial Scholarship is awarded annually, when merited, on the recommendation of the Dean of the Faculty of Graduate Studies and Research, Carleton University, to a graduate student in sociology with research interests relating to ethical issues, the family, or allied health professions. It was endowed in 1988 by family and friends in memory of Eve Kassirer.

Eve was one of the first students to receive a master's degree in sociology from Carleton University.

### **Eldon Kaye Memorial Scholarship**

Awarded annually, on the recommendation of the Chair of the Department of French, to an undergraduate or graduate student in the French program who has demonstrated the most promise in French literature. Endowed in 1989 in memory of Eldon Kaye who was a professor in the Department of French.

### **Dr. Roger Kaye Memorial Scholarship**

Awarded annually to a deserving graduate student within the department of Systems and Computer Engineering who is a resident of Ontario and requires financial assistance to



continue their studies at Carleton University. Preference is to be given to students who are undertaking studies in the field of telecommunications, and more specifically in the area of telecommunications network performance or management, of the highest academic level of excellence in collaboration with one or a consortium of Canadian corporations. Endowed in 1997, the donors include colleagues, family and friends in memory and honour of the late Dr. Roger Kaye, Professor of Systems and Communication Engineering.

### **Sherine Khalil Memorial Bursary in International Affairs**

Awarded annually to a deserving full-time student enrolled in the M.A. program in International Affairs who is undertaking work on a thesis related to developmental issues in the Third World, and who is in need of financial assistance in order to complete his/her studies. Endowed in 1990 by friends and family of Sherine Khalil, a graduate student in the Norman Paterson School of International Affairs, who died tragically in the summer of 1990.

The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from a list of possible candidates submitted each year by the Director of the School of International Affairs.

### **The Pierre Laberge Research Essay/Thesis Prize for International Affairs**

Awarded annually to a student in the Norman Paterson School of International Affairs who writes the best research essay/thesis on a topic that addresses normative or ethical issues in the field of international affairs. The prize is established in honour of the late Pierre Laberge, Professor of Philosophy and former Dean of Graduate Studies and Research at the University of Ottawa, who attended the School in 1989-92. A distinguished Kantian scholar, Professor Laberge's work in recent years focused on the vitally important questions of moral choice and ethics in international affairs. The recipient is chosen on the recommendation of a Norman Paterson School of International Affairs selection committee. The award consists of a sum of money and a book.

### **Christoph Lehmann-Halens Memorial Award**

Awarded annually, when merited, to a student enrolled in the Master of Journalism degree program at Carleton. While good academic standing is an important consideration, demonstrated interest in the issues of disarmament and/or environmental protection and/or feminist concerns are the main criteria for selection.

The recipient will be chosen each year on the recommendation of the Director of the School of Journalism and Communication.

This award in memory of Christoph Lehmann-Halens, who died tragically in Libya while on assignment, was established in 1987 by his family, friends, and Southam News.

### **The Helen Levine Bursary**

This bursary may be awarded to one or two students who require special financial assistance in order to complete their studies in social work. Preference will be given to female students who have demonstrated an interest in pursuing research and practice in women's issues or feminist counselling.

The selection of the recipient will be made upon the recommendation of the Director of the School of Social Work.

Endowed in 1990 in honour of retired Professor Helen Levine, recipient of the Governor General's Persons Award for 1989.

### **The David Lewis Research Honorarium**

Established in 1983 by the David Lewis Trust Fund, this \$2,500 research honorarium is awarded annually, when merited, to a graduate student enrolled in the master's program within the Faculties of Social Sciences or Arts. It is to assist the recipient in the preparation of a thesis or research essay dealing with the labour movement and/or democratic socialism in Canada.

Candidates are initially screened by their department and recommended to the Dean of the Faculty of Graduate Studies and Research. A short list of deserving candidates is submitted to the Board of the David Lewis Trust Fund, the members of which make the final selection of a recipient.

The winner of this honorarium will also receive an additional stipend to assist in the payment of costs associated with the writing and production of the thesis/research essay. This stipend is provided for through an endowment from the BOAG Foundation. A copy of the thesis or research essay is to be sent, upon completion, to the BOAG Foundation.

### **The John Lyndhurst Kingston Memorial Scholarship**

This scholarship was endowed in 1984 by Mrs. Leslie Kingston in memory of her late husband John L. Kingston, Architect. It is

awarded annually to an outstanding graduate student studying in a discipline within the Faculties of Arts and Public Affairs and Management, Social Sciences, Science (including Computer Science), or Engineering, whose work is aimed at the betterment of our society.

Application is not required. The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from a list of candidates recommended by departmental chairs from the above faculties.

### **R.O. MacFarlane Memorial Award**

This award is presented annually to an outstanding student registered in a graduate program in the School of Public Administration at Carleton University. Endowed in 1971 by relatives, friends, and graduates of Carleton University, the award is named in honour of the late R. Oliver MacFarlane, the first director of the School of Public Administration, 1953-1971.

### **R.A. MacKay Memorial Fund**

This fund was established in 1980 by relatives, friends, and former colleagues of the late R.A. MacKay, a distinguished scholar in Canadian government, a senior member of the Department of External Affairs, professor of political science at Carleton University from 1961, and founding associate director of the Norman Paterson School of International Affairs, 1966-68.

The award is intended to assist graduate students from outside Canada who are studying international affairs at Carleton University; they may be enrolled in the Norman Paterson School of International Affairs or come from a related discipline, such as political science, history, or economics, provided that the "international" component of their course of study is prominent.

### **The Vic Mallet Scholarship**

This scholarship commemorates Vic Mallet, an outstanding student of the Department of English, who died tragically in a car accident. Established by the department and by his family and friends, it is awarded annually, when merited, to the student with the highest academic standing on admission to the master's program. Application is not required; the recipient will be chosen on the recommendation of the Department of English.

### **The Dewan Chand and Ratna Devi Marwah Memorial Scholarship in Mathematics and Statistics**

This scholarship, valued at \$1,000, was endowed in 1984 by Professor Kanta Marwah of the Department of Economics in honour and memory of her parents. It will be awarded annually to the most outstanding and deserving graduate student within the Department of Mathematics and Statistics, preferably to a doctoral candidate who, having successfully completed all course and comprehensive requirements, is undertaking completion of a dissertation.

No application is required. The recipient will be selected by the Scholarship Committee, composed of the Chair of the Department of Mathematics and Statistics, the Director of the Ottawa-Carleton Institute of Mathematics and Statistics, and Professor Kanta Marwah or her designate. The recipient of the award will be announced by the Dean of the Faculty of Graduate Studies and Research in September each year. In a given year, the award may not be made for lack of a suitable candidate.

### **Doctoral Prize in Mathematics and Statistics**

Established in 1993 by members of the Ottawa-Carleton Institute of Mathematics and Statistics, this prize, valued at \$500, will be awarded annually for the best doctoral thesis in the Institute of Mathematics and Statistics defended during the academic year prior to September 1. Application is not required. Nominations for the prize may be made by the student's supervisor or by a member of the Executive Committee to the Chair of the Executive Committee of the Institute. In a given year, the prize may not be awarded for lack of a meritorious candidate.

### **P.D. McCormack Fund**

The purpose of the fund is to establish a memorial in perpetuity to Peter D. McCormack. The P.D. McCormack Fund is to be used for the support of graduate students in general experimental psychology in the Department of Psychology. Support may be direct (e.g., scholarships) or indirect (e.g., support of a graduate student reading room). The Chair of the Department of Psychology shall determine the deployment of funds on an annual basis.

The P.D. McCormack scholarships should be considered as prestige awards in a manner similar to the Epstein Fellowships. The Dean of the Faculty of Graduate Studies and Research, in collaboration with the Chair of the

Department of Psychology, will determine the number and amount of the awards in January of each year to be awarded in the following fall.

### **The Bruce McFarlane Bursary**

In honour of Dr. Bruce McFarlane and in recognition of his outstanding contributions during 33 years as a teacher and a scholar at Carleton University, on the occasion of his retirement in 1992, his friends, colleagues, and former students established this bursary. The Bruce McFarlane Bursary is available to full-time graduate students from the Department of Sociology and Anthropology or the Norman Paterson School of International Affairs who need financial assistance in order to meet tuition fees or cover research costs. Application is not required. The recipient(s) will be selected each year by the Dean of the Faculty of Graduate Studies and Research from candidates recommended by the above units.

### **Violet McLaughlin Scholarship**

This scholarship, which carries a value of up to \$1,000, was established in 1984 and is derived from a legacy of the late Violet McLaughlin to graduate students in the School of Social Work.

The scholarship will normally be awarded twice a year to a graduate student who, upon admission, possesses the highest academic standing; and to a student achieving the highest academic standing at the end of the first year of the program.

Application is not required; the recipients will be chosen by the awards committee from candidates recommended by the School of Social Work.

### **The Stanley Mealing Bursary**

Established in 1990 by former students, friends, and colleagues of Professor Stanley Mealing on the occasion of his retirement, this bursary is available to full-time master's or Ph.D. students in history who require financial assistance in order to continue their studies at Carleton University.

Applications should be made to the Chair of the Department of History. The selection of the recipient(s) each year will be made upon the recommendation of a selection committee comprised of the Department of History graduate committee.

### **Chet Mitchell Memorial Award in Law**

Established in 1991 by colleagues, family, and friends in honour of the late Chet Mitchell, who was a professor in the Department of Law, this award is given annually to a deserving

student enrolled in the Master of Arts program in legal studies.

Application is not required. The recipient will be chosen each year on the recommendation of the Chair of the Department of Law.

### **Molecular Recognition and Inclusion Scholarship**

Endowed in 1995 by the organizing committee of the 8th International Symposium on Molecular Recognition and Inclusion, this scholarship will be awarded annually to an outstanding student entering a graduate program in the Ottawa-Carleton Chemistry Institute. The scholarship will be used to encourage young researchers to enter the field of Molecular Recognition and Inclusion. Application is not required. The name of the recipient will be announced by the Dean of the Faculty of Graduate Studies and Research, on the recommendation of the Director of the Ottawa-Carleton Chemistry Institute.

### **Roy Buckley Morrison Scholarship**

This scholarship was established in 1979 in honour of the late Roy Buckley Morrison by Panasonic/ Matsushita Electric of Canada Limited, and friends and associates. It will normally be awarded to a Canadian citizen or permanent resident of Canada registered in the Norman Paterson School of International Affairs.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the School on the basis of merit and special interest in conflict analysis and/or studies in strategy and security.

### **George Mulligan Memorial Scholarship**

Established in 1989 by colleagues and friends of the late George Mulligan, who was a partner of Toronto Investment Management Inc., this scholarship is awarded annually, when merited, to a deserving student enrolled in the Master of Management Studies program to assist in the undertaking of research for a thesis dealing with investment management.

Application is not required. The recipient will be selected on the recommendation of the Director of the School of Business. In a given year, the award may not be made for lack of a suitable candidate, but will be held over so as to allow more than one recipient in a subsequent year.



### **Norman Paterson School of International Affairs Alumni Association Foreign Student Bursary**

Endowed by the alumni of the Norman Paterson School of International Affairs (NPSIA) in 1990, this bursary is awarded annually to one or more foreign students, admitted full time in the M.A. program in international affairs, who require(s) financial assistance in order to study at Carleton University.

The recipient will be chosen by a selection committee composed of the Director of the School of International Affairs, two representatives from the NPSIA Alumni Association, and one other faculty member from the School of International Affairs. The name of the recipient will be announced by the Dean of the Faculty of Graduate Studies and Research.

Interested applicants should contact the Director of the School of International Affairs. The bursary may not be awarded if there is no qualified candidate. In such cases it will be held over so as to allow more than one recipient in a subsequent year.

### **Maureen O'Neil Award in Women's Studies**

This award was endowed in 1985 by Canadian Hadassah-WIZO in honour of Maureen O'Neil, Coordinator, Status of Women Canada. It is awarded annually, when merited, to a student enrolled in the Faculty of Graduate Studies and Research who is doing work in the area of women's studies.

Application is not required. The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from a list of candidates recommended by each department within the Faculties of Arts or Social Sciences.

### **Robert E. Osborne Award**

Awarded annually, on the recommendation of the Chair of the Department of Religion, to an undergraduate or graduate student in the religion program. Preference, in order, will be given in the areas of New Testament, biblical, and other forms of religious studies. Endowed in 1986 in memory of Robert E. Osborne who was a professor in the Department of Religion.

### **Khayyam Zev Paltiel Doctoral Dissertation Prize in Social Philosophy, Social Theory, or Social Policy**

This prize, endowed by Professor Khayyam Z. Paltiel of the Department of Political Science, is intended to provide a fund to assist in the publication of a deserving doctoral dis-

sertation presented to the Faculty of Graduate Studies and Research at Carleton University in the fields of social philosophy, social theory, or social policy. The prize is awarded biennially to the best doctoral dissertation presented in these fields in the previous two-year period. The prize is not intended to be confined to students in a particular discipline; doctoral dissertations in the appropriate fields may be presented in political science, sociology and anthropology, economics, psychology, and history. Dissertations are nominated for the prize by the doctoral examining boards; adjudication is by a committee chaired by the Dean of the Faculty of Graduate Studies and Research and including the appropriate faculty deans together with the chairs of the relevant departments.

### **Paterson Fellowships**

From the generous support provided by the late Senator Norman M. Paterson when the School was established in 1966, funds are allocated to support some candidates for the M.A. degree in the Norman Paterson School of International Affairs.

All those with high standing who are admitted to this program are considered for these fellowships.

### **Lester B. Pearson Scholarships**

These scholarships, which were established in 1990 by a bequest from the estate of the late Lester B. Pearson, will be awarded after the first term of each academic year to three graduate students working in the areas of Canadian foreign policy, politics, or history. The awards, having a value of approximately \$1,000 each, will be made on the recommendations of the Director of the School of International Affairs and the Chairs of the Departments of Political Science and History.

### **The Norman Pollock Memorial Award for Latin American Studies**

This award is presented annually to an outstanding student in the areas of Canadian-Latin American relations or Latin American development studies. It has been endowed to honour the memory of Norman Pollock by his son David H. Pollock and his granddaughter Susan A. Harkavy.

Application is not required. The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from candidates nominated from relevant graduate programs.



### **John Porter Graduate Bursary**

An annual bursary of \$1,000 awarded to an M.A. student in sociology who requires financial assistance in order to complete studies at Carleton University. The selection of the recipient will be on recommendation of the Coordinator of Graduate Studies, Department of Sociology and Anthropology.

### **Pratt & Whitney Canada Graduate Scholarship**

Established in 1996, this scholarship is valued at \$2,000. It is awarded annually, when merited, to a student entering the Master of Engineering program in Mechanical and Aerospace Engineering specializing in gas turbine technology. Application is not required. The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research on the recommendation of the Chair of the Department of Mechanical and Aerospace Engineering.

### **Rogers Communications Award in Mass Communication**

Awarded annually to an outstanding student enrolled in the Master of Arts in Communication program. The recipient will be selected by the awards committee of the Mass Communication Program. Endowed in 1991 by Rogers Ottawa Ltd.

### **Rogers Communications Award in Television Journalism**

Awarded annually on the recommendation of the School of Journalism and Communication to the student graduating from the Master of Journalism program who shows the most promise as a television journalist. Endowed in 1991 by Rogers Ottawa Ltd.

### **The Roderick S.J. Rooney, F.C.A. Memorial Scholarship**

This scholarship was endowed in 1985 by Mrs. Isabella M. Rooney in memory of her late husband Roderick S.J. Rooney, F.C.A. It is awarded annually to an outstanding student who is enrolled in the Master of Social Work program.

Application is not required. The selection of the recipient will be decided on the recommendation of the Director of the School of Social Work.

### **William and Margaret Roxburgh Memorial Award**

This award was established in 1981 by Gwenda and Ross Roxburgh, and is open to all graduate students in the School of Canadian Studies. The amount of \$250 is provided annually

to assist students in carrying out research projects.

Application should be made to the Director of the School of Canadian Studies; recipients will be chosen from a list of candidates recommended by the Director.

### **John Ruptash Memorial Fellowship**

This fellowship was established in 1974 by relatives, former students, faculty colleagues, and friends as a memorial to the late John Ruptash, who was Dean of the Faculty of Engineering and later Dean of the Faculty of Graduate Studies and Research from 1959 to 1973. The fellowship has been awarded annually, beginning in 1975-76, to an outstanding graduate student in the Faculty of Engineering; it may be held in combination with a teaching or research assistantship.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the Faculty of Engineering.

### **The Arnold Smith Award in International Affairs**

Valued at \$1,500, this award was established in 1990 by the North-South Institute in honour of the outstanding contribution made to the Institute by its Chair of the Board, Mr. Arnold Smith. It is awarded annually, when merited, to a student who is enrolled full-time in the Master of Arts program in international affairs, is following the development studies core, and whose work focuses on Canadian policies toward developing countries in aid, trade, or international finance. Application is not required. The recipient will be selected each year by the Dean of the Faculty of Graduate Studies and Research on the recommendation of the Director of the School of International Affairs.

### **The Arnold Smith Commonwealth Scholarship**

This scholarship will be awarded annually from funds provided by the Royal Commonwealth Society, Ottawa Branch, to a student from a Commonwealth country other than Canada in any field of study at the graduate level. The award will be based on academic excellence and seeks to recognize students who will use their studies to contribute to the development of their country of origin.

Application is not required. The recipient will be chosen by the awards committee of the Faculty of Graduate Studies and Research from a list of candidates recommended by each department.

### **Social Sciences Graduate Bursary**

This fund is made possible by contributions from staff and faculty employees in the social sciences. Support of up to \$100 is available to graduate students nearing the completion of their program and experiencing financial difficulty in meeting the costs of typing/ reproduction of an M.A. or Ph.D. thesis.

Application should be made to the chair/director of the student's department, for referral with recommendation to the Dean of Arts and Social Sciences or the Dean of Public Affairs and Management, where applicable.

### **Staff and Faculty Prize in Development Administration**

Established in 1985 from the generous support provided by the staff and faculty of the School of Public Administration, this award is presented annually to an outstanding student proceeding from the first to the second year of the development administration stream in the School of Public Administration. The recipient will be chosen by the awards committee of the Faculty of Graduate Studies and Research from candidates recommended by the School of Public Administration.

### **The Frank Stone Memorial Prize**

Awarded annually, when merited, to a student graduating from the M.A. program in international affairs who presents the best thesis or research essay on Canadian trade policy. Endowed in 1990 by friends and colleagues of the late Frank Stone in honour of his contribution to the study of trade policy in Canada and to encourage others to follow in his footsteps.

Application is not required. The selection of the recipient will be decided on the recommendation of the Director of the School of International Affairs, and the winner will be announced each year by the Dean of the Faculty of Graduate Studies and Research.

### **Michael Thompson Scholarship in English**

Awarded annually, on the recommendation of the Chair of the Department of English Language and Literature, to the English Honours student with the highest GPA who is proceeding from third to fourth year of the Honours program, or from fourth year to Carleton's Master of Arts program in English. Endowed in 1992 by colleagues, friends, and former students in honour of Professor Michael Thompson's many contributions to the Department and to the University.

### **Philip E. Uren Fellowships**

Two fellowships are awarded annually, one to a graduate student in the Department of Geography and one to a graduate student in the Norman Paterson School of International Affairs, and may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be chosen by the Dean of the Faculty of Graduate Studies and Research on the recommendation of the awards committees from the academic units involved. The fellowships were established in 1980 by relatives, friends, former students, and faculty and staff colleagues as a memorial to the late Philip Ernest Uren who was a professor of geography between 1965 and 1979, and who served the University as Chair of the Department of Geography, Director of the Institute of Soviet and East European Studies, Director of the Norman Paterson School of International Affairs, and Director of the Paterson Centre for International Programs.

### **The Varian Graduate Scholarship in Analytical/Environmental Chemistry**

This Scholarship was established in 1992 by Varian Canada in recognition of its involvement in the development of the Centre for Analytical and Environmental Chemistry, in the Department of Chemistry. Valued at \$2,000, this scholarship is awarded annually to an outstanding graduate student who is carrying out research in the Centre for Analytical and Environmental Chemistry. Application is not required; the recipient will be announced by the Dean of the Faculty of Graduate Studies and Research based on recommendation from the Department of Chemistry.

### **Norma E. Walmsley Award for International Understanding**

Valued at \$2,500, this award, established in 1955 by MATCH International Centre, is to honour Dr. Norma E. Walmsley, O.C., the organization's Founding President, for distinguished service to Canada and for her outstanding contribution to the international community through university teaching and imaginative leadership in governmental and non-governmental agencies.

It is awarded annually, when merited, to a student who is enrolled full-time in the Master of Arts program in International Affairs and whose work will further international understanding between Canadian women and women of the South.

Application is not required. The recipient will be selected each year by the Dean of the Faculty of Graduate Studies and Research on the recommendation of the Awards Committee to the Director of the School of International Affairs.

### **Charlotte Whitton Fellowships in Canadian Urban Life**

In honour of the distinguished contribution of the late Charlotte Whitton to Canadian urban life and politics, and her long association with Ottawa, up to two fellowships in urban life will be awarded annually to the student(s) in the School of Canadian Studies with the highest standing on admission. The proposed field(s) of study must relate to urban life and problems.

The recipient(s) will be chosen by the Dean of the Faculty of Graduate Studies and Research on the advice of the Director of the School of Canadian Studies.

### **Alice E. Wilson, F.R.S.C. Scholarship in Geoscience**

This scholarship, valued at \$1,000, was established in 1995 by the Canadian Federation of University Women/Ottawa. It is in honour of Alice E. Wilson, F.R.S.C., a paleontologist with the Geological Survey of Canada, and a charter member of the Canadian Federation of University Women/Ottawa when it was founded in 1910.

It is awarded annually, when merited, to a graduate student enrolled in the Ottawa-Carleton Geoscience Centre. Application is not required. The recipient will be selected on the recommendation of the Director of the Centre. Preference will be given to students who are returning to studies after absences due to family responsibilities.

### **The S.F. Wise Graduate Scholarship**

This scholarship, established in 1990 by members of the Carleton community to honour a former Dean of the Faculty of Graduate Studies and Research, will be awarded annually to a doctoral student who has demonstrated research potential through publication.

Application is not required. The recipient will be chosen each year by the Dean of the Faculty of Graduate Studies and Research from a list of candidates recommended by departmental chairs and directors.

### **The Monty Wood Fellowship in Tropical Environmental Conservation**

Established in 1993 by the Faculty of Graduate Studies and Research, this fellowship recognizes and complements the substantial contribution made by Dr. Monty Wood, Adjunct Professor of Biology. This award, valued at \$1,200, will cover costs of travel and operating expenses for field research in environmental sciences or systematics of tropical ecosystems, preferably in the Americas. Applicants must have demonstrated ability in and commitment to biological conservation through volunteer work, publications, thesis topic, etc., and to passing on knowledge of ecological systems and their conservation. Demonstrated ability to conduct field studies is required.

Applications should be made to the departmental Chair, who will make a recommendation to the Dean of the Faculty of Graduate Studies and Research. The applications should include a project proposal with an objective that will result in publication of the research results.

### **YTV Canada Inc. Youth and Television Award**

Established in 1992 by YTV Canada Inc., this scholarship, valued at \$1,500, is awarded annually to a student enrolled in the Master of Arts program in Communication whose thesis topic is related to youth and television.

Application is not required. The selection of the recipient will be made upon the recommendation of the School of Journalism and Communication to the Dean of the Faculty of Graduate Studies and Research.

### **Residence Fellowships**

Applications are invited from graduate and senior undergraduate students with good academic standing. The Residence Fellowship responsibilities include supervision of a floor in residence, enforcement of community regulations, and counselling of students in residence. An excess of twenty hours per week is required to meet job responsibilities satisfactorily. Please note that the selection process demands that candidates attend an interview and a workshop in the second term.

Application forms may be obtained from the office of Housing and Food Services, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, K1S 5B6. The deadline for receipt of applications is January 15.



### **Special Bursary for Students in Social Work**

This bursary, in the amount of \$1,000 annually, may be awarded to one, or divided between two students in the School of Social Work who require special financial assistance in order to complete their studies at Carleton University. The selection of the recipient(s) will be decided on the recommendation of the Director of the School of Social Work.

### **Awards Tenable at Carleton University**

#### **Commonwealth Scholarships and Fellowships**

The Government of Canada, through the Commonwealth Scholarships and Fellowships Committee, offers annually a number of scholarships and fellowships, normally tenable for two years, which cover such expenses as travelling costs, tuition fees, other University fees; and a living allowance to students of other Commonwealth countries.

Under a plan drawn up at a conference held in Oxford in 1959, these scholarships and fellowships are awarded mainly for graduate study, and are tenable in the country making the offer.

Students are advised to consult Carleton International. The deadline for receipt of applications is October 26 for all awarding countries except New Zealand. The deadline for receipt of applications for New Zealand awards is December 24. For further details, please contact Please contact the International Council for Canadian Studies/Conseil International d'études canadiennes, 325 Dalhousie, S-800 Ottawa, Ontario, Canada, K1N 7G2, or at their Web site at: <http://www.iccs-ciec.ca>.

#### **I.O.D.E. War Memorial Scholarships**

Up to a maximum of eight scholarships are offered annually by the Imperial Order Daughters of the Empire for postgraduate study and research in the humanities or social sciences. The awards are valued at \$12,500 for study in Britain or another country in the Commonwealth, and \$10,000 for study in a Canadian University.

Candidates must be Canadian citizens and graduates of recognized colleges or universities.

Application forms are available from the office of the Faculty of Graduate Studies and Research. The deadline is December 1.

### **Sir John A. Macdonald Graduate Fellowship in Canadian History**

The Province of Ontario annually offers the Sir John A. Macdonald Graduate Fellowship, valued at \$8,500, for full-time graduate studies and research in the field of Canadian history at the Ph.D. level. The fellowship is tenable for three years, at an Ontario University only, and it will be awarded to a Canadian citizen resident in Ontario.

Application forms and additional information can be obtained from the Graduate Studies and Research office. The deadline for submission of completed applications to the Dean of the Faculty of Graduate Studies and Research is March 15.

### **Department of National Defence Scholarships and Fellowships**

The Department of National Defence offers scholarships and fellowships for strategic studies of relevance to current and future Canadian national security problems, including their political, economic, social, and military dimensions. Eight Ph.D. scholarships valued at up to \$12,000 and eight M.A. scholarships valued at up to \$10,000 will be awarded to cover tuition fees and related expenses.

Applicants must be Canadian citizens. The deadline is February 1.

### **Natural Sciences and Engineering Research Council**

NSERC Postgraduate Scholarships (range \$17,300 - \$19,100) are tenable at Carleton University by students undertaking advanced studies and research in science, engineering, experimental psychology, and physical geography.

Students currently enrolled at Carleton University must apply through their departments on prescribed forms available from the office of the Faculty of Graduate Studies and Research. Departments will advise students of relevant deadlines. Candidates are advised to consult the Council's Web site at: <http://www.nserc.ca>

### **Noranda Bradfield Graduate Fellowship Program**

The Noranda Bradfield Graduate Fellowships are given to promote and encourage research collaboration between Canadian universities and companies in or associated with the Noranda Group. Up to seven fellowships, each valued at \$15,500, are available to full-time students in graduate programs leading towards a



master's or doctoral degree who are working in the natural and applied sciences, mathematics, economics, business, and commerce.

Application should be made through the appropriate University department to the Secretary, The Noranda Bradfield Graduate Fellowship Program, Noranda Research Centre, 240 Hymus Boulevard, Pointe Claire, Quebec, H9R 1G5, not later than March 1.

### Ontario Graduate Scholarships

The Province of Ontario annually offers scholarships of \$3,953 per term to students who intend to pursue graduate studies at an Ontario University. Applicants must have maintained an overall average of at least A-, or the equivalent, during each of the last two years of study at the postsecondary level.

Application forms and brochures containing details of the award may be obtained from the student's department. Registered students should submit completed application forms to their department. The department will advise students of the relevant deadlines.

### Queen's Fellowships

Two or three Queen's Fellowships will be awarded annually to the most highly-ranked Doctoral Fellowship recipients entering the first year of a doctoral program in Canadian Studies. The fellowships are tenable only at a Canadian University and will provide tuition and travel costs in addition to the basic Doctoral Fellowship award.

### J.H. Stewart Reid Memorial Fellowship

This fellowship provides an award of \$5,000 for twelve months for any field of study in a doctoral program in any Canadian University. It is open to students who are Canadian citizens, or who have held landed immigrant status from April 30 and have been admitted to a Canadian graduate program by the time of award. Applications may be obtained from the Awards Officer, Canadian Association of University Teachers, 2675 Queensview Drive, Ottawa, Ontario, K2B 8K2.

### Social Sciences and Humanities Research Council of Canada

The Council offers fellowships ranging in value up to \$16,620 for studies and research at the doctoral level in the humanities and social sciences. These fellowships are tenable in Canada or abroad for a maximum of twelve months and may be renewed upon application.

Departments will advise students of the deadline. The Guide to Applicants and applications forms for the doctoral fellowship program are available on the Council's Web site at: <http://www.sshrc.ca>

## Government Aid Programs

### Ontario Residents

Canadian citizens or landed immigrants (permanent residents) who are residents of Ontario may qualify for assistance from the Ontario Student Assistance Program. The financial aid scheme is designed to supplement, rather than replace, family and/or student resources. In order to determine the additional funds required, the province objectively assesses the resources that could reasonably be used to provide for the student's educational costs. Interest free Canada Student Loans and/or Ontario Student Loans are given to assist the student. The maximum loan a student can receive in one academic year is usually the total amount of his or her allowable educational costs. Application forms and further information can be obtained by contacting the Awards office at Carleton or the Student Awards Branch of the Ministry of Education and Training, Fellowship Section, P.O. Box 4500, 189 Red River Road, 4th Floor, Thunder Bay, Ontario, P7B 6G9.

Students wishing to have applications processed in time for fall registration must ensure that completed forms are submitted to the Awards office by July 1.

### Residents of Other Provinces/Territories Except Quebec

Canadian citizens or landed immigrants (permanent residents) from the territories and all other provinces except Quebec may qualify for assistance from the Canada Student Loans Plan through their home province. The loan is interest free while the student is enrolled full time. Some provinces also make available non-repayable grant assistance along with this federal loan.

The Awards office disburses general information on the various provincial aid schemes, but application forms and details on individual programs must be obtained from the authorities in the home province. Deadline dates vary but, generally speaking, it is wise to apply for financial assistance through the appropriate provincial department before June 30.

### **Quebec Aid**

Applications from students for assistance from the province of Quebec should be made directly to the Awards office. Deadline dates for submission of applications are May 31 for all students who submitted an application for the previous school year and June 30 for all students who did not submit an application for the previous school year. In order to be accepted by the Department of Education, all applications must be coded by the Awards office.

The above government assistance programs are subject to change.

### **University Loan Funds**

#### **John Parker Loan Fund**

This fund was established to provide loans of up to \$1,000 to students in their first year of studies at Carleton University, and up to \$1,500 in future years to students who require financial assistance to meet their educational costs. This fund also provides emergency loans for 60 days or less to students whose funds from other sources have been delayed. Application forms are available to students in the Awards Office, Room 202, Robertson Hall, telephone 520-3600.

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## General Regulations

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## 1. Administration of the Regulations

### 1.1 General Administration

The regulations on the following pages apply to all degree, diploma and certificate programs administered by the Faculty of Graduate Studies and Research.

### 1.2 Student Responsibility

(i) The student is responsible for knowing the regulations of the Faculty of Graduate Studies and Research and for complying with them. Any exceptions to the regulations must be approved, in writing, by the Dean of the Faculty of Graduate Studies and Research. Routine approval of a records form does not constitute approval of an exception.

It is also each student's responsibility to establish and maintain contact with his or her faculty adviser or thesis supervisor.

(ii) In order for a student to receive his or her degree, he or she must fulfill:

- \* all the requirements of the department, school, or institute in which he or she is taking the degree;
- \* all faculty regulations;
- \* all University regulations;
- \* all financial obligations to the University.

## 2. Admission Requirements and Eligibility

### 2.1 General Requirements

Graduates of recognized universities will be considered for admission to the Faculty of Graduate Studies and Research. The University's general policy on admission is outlined below, but all applicants should refer to the departmental statements in this Calendar for details concerning the specific or additional requirements of each department, institute, or school.

### 2.2 Eligibility

A combination of factors is taken into consideration in assessing the eligibility of a candidate for admission into one of the graduate programs:

- \* the performance of the candidate and the assessment provided by his/her referees as a measure of the likelihood that the candidate can successfully complete the course of studies and research defined by the Senate of the University for the given degree

- \* the capacity of the graduate department, institute, or school to provide a program of studies and research which would meet the expectations of the candidate as defined in his/her statement of academic interests and ambitions

- \* the availability of a faculty member competent to supervise the academic program of studies and research of the candidate at the time.

### 2.3 Qualifying-Year Program

Applicants who do not qualify for direct admission to the master's program may be admitted to a qualifying-year program. Applicants who lack an Honours degree but have a 3 year degree with honours standing (at least B overall) will normally be admitted to a qualifying-year program.

If successful in this qualifying year and upon formal application to the Faculty of Graduate Studies and Research, the student may eventually proceed to the master's program. However, admission to the qualifying-year program does not imply automatic admission to the master's program. At the end of the qualifying-year program the student will be required to apply for entry into the master's program, at which time the department will determine the student's eligibility to enter the program. If successful, the student will be informed of this decision by the Dean of the Faculty of Graduate Studies and Research.

Applicants for a master's degree who have a program requirement of 7.5 credits or more

(with the exception of the School of Public Administration and the School of Journalism and Communication) will register initially in the qualifying-year program.

Credits taken to fulfill the requirements of the qualifying-year program may not be used for credit for the master's degree. Courses taken extra to the program requirements of the qualifying year and which have been successfully completed may be considered for credit towards the master's degree.

## 2.4 Master's Program

For admission to the master's program, applicants must hold an Honours bachelor's degree, or the equivalent, with at least high honours standing (normally B+ or better in honours subject; B- or better overall). The applicant must also be recommended by the department in which he/she plans to undertake his/her studies.

Applicants for a master's degree who have a program requirement for 7.0 credits or less will register directly in the master's program.

## 2.5 Doctoral Program

For admission to the Ph.D. program, applicants must ordinarily hold a master's degree, or the equivalent, from a recognized university, normally with an average of B+ or better in courses (including thesis where applicable) and normally with no grade below B-.

## 2.6 Restriction on Degrees

Applicants should note that, while Carleton University does not restrict the number of degrees (bachelor's, master's, Ph.D.) that may be taken in any one discipline, some departments and schools may restrict the number to two.

## 2.7 Certificate Program

For admission to the certificate programs, applicants are advised to consult with the individual departments offering the certificate.

## 3. Application for Admission

### 3.1 Senate Policy Statement on Accessibility for the Disabled

Carleton University is committed to making reasonable accommodation to individuals with disabilities and actively encourages application from disabled students. This commitment includes gaining an understanding of the circumstances of an individual's disabilities and to adjusting services to all academi-

cally qualified individuals enabling them to compete on an equitable basis.

Students are encouraged to contact the Paul Menton Centre for Persons with Disabilities for further information to enable them to assess the extent to which specialized services will be available.

Academic accessibility is intrinsically linked to physical accessibility. Carleton is committed to continually monitoring and upgrading physical accessibility to whatever extent is possible.

A Standing Committee of Senate monitors the needs and problems of disabled students in conjunction with their academic problems and makes recommendations for improvements.

(See General Information, Student Life Services, Persons with Disabilities, p. 23).

## 3.2 Application Forms

Applications for admission to the Faculty of Graduate Studies and Research should be made on prescribed forms, available from the major department or the office of the Faculty of Graduate Studies and Research, and they should be submitted directly to the department. To cover administrative costs, a non-refundable charge of \$35 (Cdn. or U.S. funds) is required with each application.

## 3.3 Deadlines

The Faculty of Graduate Studies and Research normally admits students to commence in the fall term. However, some academic units may consider applicants to commence in the winter term or the spring/summer term. Applications for admission may be submitted at any time. Applications for admission from outside Canada should be completed at least five months before the desired date of admission in order for students to make the necessary visa arrangements.

Applicants wishing to be considered for financial assistance from Carleton University are reminded that they must submit their completed applications before March 1. Please note that some schools and departments may require completed applications prior to March 1. Students should refer to departmental entries in this Calendar for details.

Students applying to joint programs with the University of Ottawa should note that application procedures, especially deadlines, are different in the two institutions, and they should refer to the university calendars for details.

### 3.4 Transcripts

Two detailed *official* transcripts of the applicant's entire university record must be sent to the chair of the department concerned. All foreign documents, e.g., transcripts, must be translated into English and be notarized.

### 3.5 Letters of Reference

All applications must be supported by letters of recommendation from at least two faculty members with whom the candidate has studied, who are in a position to assess his/her potential for graduate studies and research. References from non-academic supervisors are not ordinarily acceptable, except in certain cases, such as that of an applicant working in a research laboratory environment. All letters of reference are to be sent by the referees directly to the chair of the department.

### 3.6 Proficiency in English

Proficiency in English is necessary to pursue graduate studies at Carleton

University. All applicants whose first language is not English must satisfy

this requirement in one of the following ways:

(i) certification that the language of instruction in their most recently completed undergraduate or graduate degree was English; or

(ii) an overall score of 60 or better on the Carleton Academic English Language Assessment with a minimum score of 60 for the writing section (some programs may require a higher standard of performance); or

(iii) a TOEFL score of 550 or better (some programs may require a higher standard of performance).

## 4. Admissions Procedure

### 4.1 General Procedure

All applicants for admission will initially be examined and evaluated by the department, institute, or school in which the applicant wishes to study. All supporting documents (transcripts, letters of reference, etc.) must be received before any application can receive formal consideration.

Completed applications of those students whom the department wishes to recommend for admission will be forwarded to the Dean of the Faculty of Graduate Studies and Research for consideration. The office of the Dean will officially notify each applicant whose admission is approved.

### 4.2 Admission Validity for New Students

The Statement of Standing on Admission issued to each newly-admitted student is valid only for the twelve month period stipulated on the form. If the applicant fails to register within this period of time, his/her admission and registration eligibility will lapse automatically. He/she may re-apply for admission.

### 4.3 Revocation of Admission or Registration

The University may nullify an admission and revoke a registration if it finds that an applicant for admission or registration has, in the process, provided false or incomplete information.

## 5. Program Requirements

### 5.1 General Information

A description of each program offered under the auspices of the Faculty of Graduate Studies and Research is presented in the departmental Program Descriptions and Details of Courses section of this Calendar. Prospective applicants should note particularly the admission requirements, the fields in which advanced study and research may be undertaken, and the program requirements of each department, in addition to the general regulations of the Faculty of Graduate Studies and Research, which are spelled out in this section.

### 5.2 Qualifying-Year Program

Students in the qualifying year will ordinarily register in 5.0 credits, at the senior undergraduate level. Of these five, normally no more than 1.0 credit at the 200-level and no more than 2.0 credits at the 500-level may be taken.

### 5.3 Master's Program

The normal requirement for the master's degree is 5.0 credits, of which at least 4.0 (including the thesis where applicable) must be at the 500-level. With departmental approval, the remaining 1.0 credit may be selected from those offered at the senior undergraduate level, that is, at the 400-level.

Where applicable, the normal requirement for a 10.0 credit master's degree is 10.0 credits, of which at least 8.0 credits (including the thesis where applicable) must be at the 500-level. With departmental approval, the remaining 2.0 credits may be selected from those offered at the senior undergraduate level, that is, at the 400-level.



## 5.4 Doctoral Program

Ordinarily, all courses taken for credit towards the Ph.D. degree must be at the 500- or 600-level.

The thesis will ordinarily carry a weight of about half of the total requirement of 10.0 credits.

## 5.5 Language Requirements

Some graduate programs require a reading knowledge of one or more languages other than English. Language requirements will be prescribed by departments according to their regulations and the needs of their students. Language requirements must be completed within the time limit allowed for the completion of the student's program.

## 6. Transfer of Credit

### 6.1 Transfer of Credit on Admission

Graduate courses completed at another institution or at Carleton University may be accepted in partial fulfilment of Carleton's degree requirements. Credit for such work will be determined in each case by the Faculty of Graduate Studies and Research on the recommendation of the department concerned. Master's candidates in a 5.0 credit program are allowed a maximum of 2.0 transferred credits. In addition, if a master's candidate is granted transfer of credit for 2.0 credits, his/her remaining 3.0 credits at Carleton must be at the 500-level.

Master's candidates in a 10.0 credit program are allowed a maximum of 4.0 transferred credits. In addition, if a master's candidate is granted transfer of credit for 4.0 credits, his/her remaining 6.0 credits at Carleton must be at the 500-level.

Doctoral candidates may be given up to one year's credit for work completed at other universities but must normally register for a minimum of one year of full-time studies thereafter at Carleton and fulfill the thesis and comprehensive examination requirements. Students admitted with transfer of credits in a Ph.D. program may be required to pass a qualifying examination upon entry.

A candidate who has completed credits as a special student is not normally permitted to transfer such credits for degree credit in the Faculty of Graduate Studies and Research.

Special students enrolled in a graduate level course are subject to the special student regulations outlined in the *Undergraduate Calendar*.

## 6.2 Transfer of Credit After Admission

A student formally admitted to and eligible to register in a graduate program is not permitted to register at Carleton University at the same time in any other graduate program or as an undergraduate or special student. Should he/she do so, credits may not be transferred.

Similarly, if a student normally admitted to a graduate program at Carleton wishes to enroll in courses at another university, credit will be granted only if written permission is received from the Dean of the Faculty of Graduate Studies and Research. Such permission must be received in advance of registration for the course work. *In no case will such transfer alter the maximum number of allowable transferred credits noted above.*

## 7. Registration and Course Selection

### 7.1 The Calendar Year

The Faculty of Graduate Studies and Research divides the calendar year into three terms, and the academic year (September-May) into two terms; each term comprises about thirteen weeks of lectures or seminars. The first term of the academic year is designated as the *Fall term* (registration period at the beginning of September); the second term of the academic year is designated as the *Winter term* (registration period early in January); and the third term of the calendar year is designated as the *Spring/Summer term* (registration period in early May). The precise dates of registration for the Fall, Winter, and Spring/Summer terms are specified in the academic schedule (see p. 11).

### 7.2 Course/Program Approval

Graduate students must have approval from their departmental supervisor of graduate studies for initial course/program registration, and for any subsequent course changes. This approval is also required for any undergraduate student who wishes to register in a graduate-level course.

Credit will be granted only for those courses and research activities for which the candidate is formally registered. An unregistered student is not entitled to attend lectures, tutorials, or seminars, and is not entitled to thesis supervision, examination privileges, or access to research facilities. A student will receive no credit for any work completed during a term in which he/she was not properly registered.



### 7.3 Student Records Information

#### *Names*

As the University is committed to the integrity of its student records, each student is required to provide on the application for admission his/her complete, legal name. Any requests to change a name, by means of alteration, deletion, substitution, or addition, must be accompanied by appropriate supporting documentation. Upon making application for graduation, students may be asked to provide proof of their name.

#### *Addresses*

Incorrect address information will delay the receipt of awards and student information. Students must notify the office of the Faculty of Graduate Studies and Research immediately of any change in:

- \* permanent or home address (used for registration information)
- \* local address (used for all mail during the academic session)
- \* telephone number for permanent address and for local address

### 7.4 Revocation of Registration/Admission

The University may nullify an admission and revoke a registration if it finds that an applicant for admission or registration has, in the process, provided false or incomplete information.

### 7.5 Course Selection

A student proceeding to a graduate degree, diploma, or certificate must arrange his/her program according to the regulations of the Faculty of Graduate Studies and Research and the major department.

The course and thesis requirements of each graduate program are organized or defined in units of credits: 1.0 credit typically comprises three hours of lectures or seminars a week for two terms, or the equivalent; 0.5 credit typically comprises three hours of lectures or seminars a week for one term, or the equivalent.

### 7.6 Evaluation

To gain standing in a course, a student must meet the course requirements for attendance, term work, and examinations.

Instructors will inform their classes by distributing written notices, before the last day for late registration, of the elements and their weighting that will contribute to the final grade,

including (where applicable) attendance, class participation, essays, tests, laboratories, studio-workshops, other course-related work assignments, and final examinations.

### 7.7 Tutorials

These are arranged to allow students to take full advantage of all the resources of the University, even in areas or fields of a very highly specialized nature. Such arrangements are subject to the approval of the supervisor of graduate studies, who will arrange that a document spelling out the details of the topic, reading list, etc., is submitted to the office of the Faculty of Graduate Studies and Research before the last day for course changes in the term concerned.

### 7.8 Audit Course

Graduate students may register to audit 1.0 credit per program.

- \* Full-time students will not be charged an additional fee; others must pay the prevailing fee for part-time students.
- \* Part-time students will not be permitted to audit a course in addition to two 0.5 credits per term.

### 7.9 Course Numbering System

Each course is identified by a seven-symbol code. The first two digits indicate the department, school, or committee under whose auspices the course is offered. The three digits following the decimal point identify the specific course. The letter which follows the course number designates the term in which the course is offered: F denotes Fall term; W, Winter term; S, Spring/Summer term; and T, two terms (Fall and Winter). The number which follows the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

### 7.10 Status

#### *Prior to May 1, 1996*

All students admitted and registered prior to May 1, 1996 are reminded that status is established by formal registration in the appropriate courses for each term of activity in the calendar year. Those students registering solely in a thesis, research essay, or independent research project will declare whether their status is full time or part time according to the definition in 7.11 and 7.12.

#### *Important Note*

All students in this category will be eligible for post-residency fee rates for the duration

of their program unless:

- (i) a re-admission is required because the time for completion of degree has expired
- (ii) a new admission is required in cases of an approved degree transfer or new degree admission.

In the cases noted above, students will lose their grandparent fee status and will be subject to the current fee rates, i.e., the same fee rates that apply to students initially registered and admitted after May 1, 1996.

#### *After 1 May 1996*

All students admitted and registered after May 1, 1996 should note:

(i) the elimination of post-residency status and fee rates associated with post-residency for all admitted graduate degree students. Post-residency is defined as those students in the second or subsequent year of full-time study in a master's program; third or subsequent year of full-time study in the School of Public Administration, School of Journalism and Communication, or School of Social Work; and third or subsequent year of full-time study in a Ph.D. program.

(ii) that full- or part-time status is established by admission status and initial program registration. Graduate students admitted and registered after May 1, 1996 who apply and are admitted as full-time students and who initially register as full-time students will be required to continue and complete their program as full-time students, and will be assessed full-time fees for the duration of their program; graduate students admitted and registered after May 1, 1996 who apply and are admitted as part-time students and who initially register as part-time students will be required to continue and complete their program as part-time students, and will be assessed part-time fees for the duration of their program.

### **7.11 Definition of Full-Time Status**

*Full-time course load for all students (admitted and registered prior to and after May 1, 1996)*

A full-time graduate student will normally register in a minimum of 1.5 credits per term. An audit is not permitted as part of the 1.5 credits required per term to maintain full-time status.

In addition to the course load requirements described above, the following criteria for full-time status have been established by the Faculty of Graduate Studies and Research for all students (admitted and registered prior to

and after May 1, 1996).

A full-time graduate student must:

- (i) identify himself or herself at the point of first registration as a full-time graduate student
- (ii) be considered a full-time graduate student by his or her supervisor
- (iii) be designated as a full-time graduate student by the University

Students who are unsure of their status should contact the office of the Faculty of Graduate Studies and Research for assistance, at 520-2525.

### **7.12 Definition of Part-Time Status**

Part-time course load for all students (admitted and registered prior to and after May 1, 1996)

A part-time graduate student will normally register in a maximum of 1.0 credit per term, including audit courses.

In addition to the course load restriction described above, the following criteria for part-time status have been established by the Faculty of Graduate Studies and Research for all students (admitted and registered prior to and after May 1, 1996).

A part-time graduate student must:

- (i) identify himself or herself at the point of first registration as a part-time graduate student
- (ii) be considered a part-time graduate student by his or her supervisor
- (iii) be designated as a part-time graduate student by the University

### **7.13 Change of Status from Full-Time to Part-Time**

Students who have valid reasons for changing status from full-time to part-time for a term may apply for permission by:

\* writing to the Dean of the Faculty of Graduate Studies and Research stating the reason(s) for seeking exemption from the full-time registration requirements stated in 7.10 and 7.11

\* requesting a statement from the departmental graduate supervisor (and the thesis supervisor if there is one) in support of their request, confirming that they will be infrequently on campus for the term, will be using the University facilities (i.e., library, laboratories, computer centre, etc.) on a part-time basis, and will be receiving supervision on a part-

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time basis, including supervision through correspondence

It is understood that such a status change will be granted only in exceptional cases (e.g., for medical or other special reasons.)

Exemptions are normally granted for a term, but, in extraordinary circumstances, approval may be granted for a longer period.

### 7.14 Off-Campus Research

In the interest of enriching their learning experience, graduate students may arrange to undertake full-time studies or research at another institution or in the field. It should be understood that such activity would apply to only a part of the total program and that the off-campus period would not normally exceed twelve months.

Requests for permission to undertake full-time off-campus study or research must be submitted, well in advance, to the Dean of the Faculty of Graduate Studies and Research through the department concerned. Such requests should include the following information:

- \* a detailed statement of the research proposal or program of studies, and the specific arrangements that are proposed for the supervision and direction of the work

- \* an explanation of the reasons why the work cannot be satisfactorily undertaken while on campus at Carleton University

- \* a description of the studies and/or research facilities that are available at the proposed off-campus location

- \* a written statement from a responsible official (for example, the on-site supervisor or director) of the outside institution confirming that the proposed arrangements are satisfactory and that the candidate will be able to undertake research or studies

- \* a time schedule for the proposed studies or research work

- \* a statement of the candidate's expected sources of financial support

### 7.15 Inter-University Cooperation in Graduate Instruction

Under certain circumstances, it is permissible for a student admitted to a graduate degree program and registered at one Ontario university to follow an approved credit course at another university. All interested students should consult the chair of their department, prior to registration, in order to obtain further information on procedures and condi-

tions of eligibility. In order for this procedure to be valid, students must be officially registered at their home institution by contacting the office of the Faculty of Graduate Studies and Research.

### 7.16 University of Ottawa

Carleton University and the University of Ottawa have developed a number of joint programs at the graduate level. The details of these are given under the appropriate academic unit later in this Calendar.

Where formal joint programs do not exist, a graduate student may be permitted to follow up to 2.0 credits at the University of Ottawa. Moreover, there are reciprocal arrangements worked out among departments, institutes, and schools at both universities to involve students, when it is desirable, in parts of the program of research and studies at the other institution. All interested students should consult the chair of their department, institute, or school, prior to registration, in order to obtain further information on particular departmental conditions of eligibility and procedures. In order for this procedure to be valid, students must be officially registered at their home institution by contacting the office of the Faculty of Graduate Studies and Research.

## 8. Continuous Registration

### 8.1 Loss of Status

Any candidate who remains unregistered in his/her degree program for three terms (twelve months) will lose his/her graduate status.

### 8.2 Continuous Registration in Thesis, Research Essay, or Independent Research Project

Any candidate (full-time or part-time), after initial registration in a thesis, research essay, or independent research project, must maintain this registration in all successive terms (including the term in which the student is examined) until his/her thesis, research essay, or independent research project is completed. Completion means modifications, any retyping involved, etc. Students should note that faculty approval to register in the thesis, etc., is given on the understanding that the student will be in regular contact with his/her supervisor, and that thesis research will be actively pursued in each term of registration.

### 8.3 Deposit of Thesis Copies

In the case of a thesis, registration must be maintained until five final copies are depos-



ited in the office of the Faculty of Graduate Studies and Research. Should the final copies not be deposited in the office of the Faculty of Graduate Studies and Research by the last day for late registration in a given term, the student will be required to register for that term.

### 8.4 Reinstatement

Students whose files have been closed as a result of failure to observe continuous registration requirements must apply for reinstatement if they wish to continue their studies. If reinstated, students must pay a reinstatement charge which consists of \$50 *plus the equivalent of 1.0 credit tuition fees for each term in which they failed to register.*

The reinstatement charge is a tuition fee and therefore is defined as eligible for income tax deduction.

### 8.5 Exemption from Registration

Students who have valid reasons for not registering for a term may apply for permission to remain unregistered by:

- \* writing to the Dean of the Faculty of Graduate Studies and Research stating the reasons for seeking exemption from registration

- \* requesting a statement from the departmental supervisor of graduate studies (and from their thesis supervisor, if there is one) in support of their request, confirming that they will not be on campus for the term, will not use any University facilities (that is, library, laboratories, computer centre, etc.), or receive any supervision, including supervision through correspondence

- \* applying to the Dean of the Faculty of Graduate Studies and Research through their graduate department for a one- to three-term maternity leave during their program of study. While on leave students will not be registered with the faculty, nor will they be required to pay fees for this period. They will not be eligible to receive awards administered by Carleton University during the leave. In the case of other awards, the regulations of the particular granting agency will apply. The time limit for completion of the program will be extended by the duration of the leave taken. Where possible, the start and finish of the leave should coincide with the start and end of a term.

A charge of \$50 per term for leave of absence must accompany each request.

It is understood that such an exemption from registration will be granted only in exceptional

cases (for example, medical or other special reasons).

Exemptions are normally granted for one term, but in extraordinary circumstances an exemption may be granted for a longer period.

When exemption from registration for a term or terms has been approved by the Dean of the Faculty of Graduate Studies and Research, this period will be exempt from the overall time limit allowed for completion of the program.

### 8.6 Off-Campus Registration

Students who have been permitted to study off campus while registered full-time at Carleton, may register using Touchtone Telephone Registration.

### 8.7 Course Changes

A course change is the addition or deletion of one or more individual courses by a registered graduate student. This is the only acceptable procedure for revising or correcting a graduate student's registration. All course changes must be approved by the student's department.

Note: The deadline dates for course changes are stipulated in the academic schedule of this Calendar.

### 8.8 Withdrawal

A graduate student wishing to terminate his/her registration in a graduate program (that is, drop all courses) must consult with his/her department prior to withdrawal.

#### *\*Withdrawal Credit*

When a student officially withdraws, a withdrawal credit will be calculated on a *pro rata* basis as of the date of withdrawal or receipt of letter. Credit for fees or refunds will depend on the date of withdrawal and the amount of fees originally paid. Students are encouraged to examine the financial implications of withdrawal. A refund schedule is available at the Business Office

#### *\*Mid-Term Transfer of Program*

Graduate students are cautioned that there is no procedure at Carleton University for direct "mid-term" transfer from one graduate program to another. Similarly, there can be no direct transfer to or from undergraduate or special student status. Any candidate who elects to change programs after registration (before the last day of late registration) will be required to withdraw from the first program and then register in the second. The *pro rata* refund of fees calculated as a result of with-



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drawal from the first program can be applied against the new fee assessment for the second program.

### *\*Degree Completion*

A registered candidate who completes his/her degree requirements by depositing the thesis/research essay prior to the last day for withdrawal in any term (as specified in the academic schedule) is required to withdraw formally if he/she anticipates any refund of fees.

*Note:* This only applies to thesis or research essay registration.

## 9. Examinations

### 9.1 General Remarks

Final examinations in courses will be held at the times indicated in the academic schedule. Graduate students must obtain grades that meet the standards outlined in Section 11, Academic Standing and that satisfy the specific requirements of the department concerned.

### 9.2 Special/Deferred Final Examinations

A graduate student who is unable to write a final examination because of illness or other circumstances beyond his/her control, or whose performance on the examination has been impaired by such circumstances, may apply to write a special or deferred final examination. Such an application will be considered only if it is submitted in writing to the Dean of the Faculty of Graduate Studies and Research within two weeks of the examination.

If the student has been seen at the University Health Services, the office of the Dean will confirm the illness by contacting the treating physician. If the student has consulted a physician outside the University, he/she will be required to submit a statement from the physician confirming the illness.

In cases other than illness, appropriate documents will be required.

Students with special needs may also apply for special/deferred final examinations by contacting the Faculty of Graduate Studies and Research.

### 9.3 Master's Examinations and Deadlines

In addition to any examination which may be required in individual courses, a master's candidate who is writing a thesis will be expected to undertake either an oral defence of the thesis or a comprehensive examination in his/her field of specialization, or both. Please re-

fer to Thesis Specifications, Section 12.5, Master's, for submission deadlines. When the degree is taken by course work, a comprehensive examination may be required. It is important to note that individual departments may have additional or particular requirements.

Some departments specify deadlines for the submission of thesis proposals and for comprehensive examinations. Students should check the Calendar entry for their department.

### 9.4 Doctoral Examinations and Deadlines

Doctoral candidates may be asked to pass a qualifying examination at the beginning of their residence at Carleton University.

A comprehensive examination covering prescribed fields will normally be undertaken one year prior to the thesis presentation. This examination (oral or written, or both) may include any material considered fundamental to a proper comprehension of the field of study.

After the thesis has been received and accepted for examination, a final oral examination on the subject of the thesis and related fields will be held. Please refer to Thesis Specifications, Section 12.5, Doctoral, for submission deadlines.

Some departments specify deadlines for the submission of thesis proposals and for comprehensive examinations. Students should check the Calendar entry for their department.

### 9.5 Comprehensive Examinations

The date, place, and time of comprehensive examinations will be announced at least two weeks in advance. An examining board will be appointed according to the guidelines laid down by the Faculty of Graduate Studies and Research.

### 9.6 Unsatisfactory Grades

If the comprehensive examination is graded *Unsatisfactory*, the department may permit the candidate to repeat the examination. If the comprehensive examination is graded *Unsatisfactory* for a second time, a request by the department that the candidate be allowed to continue in the program would require the approval of the Faculty of Graduate Studies and Research.

The comprehensive and thesis examination processes must be conducted according to the principles and practices prescribed by the Faculty of Graduate Studies and Research.

## 10. Grading System

### 10.1 Letter Grades

Carleton University employs the twelve-point system of letter grades to represent standing in graduate lecture courses, directed studies, seminars, tutorials, and some research essays. The letter grades used and the grade point equivalents are as follows:

A+	12	B+	9
A	11	B	8
A-	10	B-	7
C+	6	D+	3
C	5	D	2
C-	4	D-	1

The following percentage equivalents apply to all final grades at Carleton.

A+	90-100	B+	77-79
A	85-89	B	73-76
A-	80-84	B-	70-72
C+	67-69	D+	57-59
C	63-66	D	53-56
C-	60-62	D-	50-52

### 10.2 Other Grading Notations

Under certain defined circumstances, notations are used instead of letter grades to represent standing. The only notations permissible in the Faculty of Graduate Studies and Research are the following:

\* a notation of *Satisfactory* or *Unsatisfactory* may be assigned, subject to the approval of the Faculty of Graduate Studies and Research, in certain very special courses involving practicum, field work, or other complex activities not easily adaptable to the twelve-point system of grading

\* comprehensive examinations are graded *Pass With Distinction*, *Satisfactory*, or *Unsatisfactory*

\* the master's thesis is graded *Pass With Distinction*, *Satisfactory*, or *Unsatisfactory*. The oral defence is graded *Satisfactory* or *Unsatisfactory*

\* the Ph.D. thesis and its oral defence are each graded *Satisfactory* or *Unsatisfactory*

\* a notation of *Incomplete* may, subject to the approval of the chair of the department, be assigned to a course in which the student has been granted the privilege of submitting an assignment after the final deadline date. This notation of *Incomplete* will be permissible only in exceptional cases (for example, medical or other special reasons) and must be replaced with a letter grade within *forty* days of the end of classes. If the notation of *Incomplete* is not changed to a letter grade (through the regular change-of-grade procedures) within *forty* days of the end of classes, the *Incomplete* notation will be changed to a grade of F, which will remain as a permanent entry on the student's record. In exceptional cases students may petition the Dean of the Faculty of Graduate Studies and Research to have the *Incomplete* notation remain on the student record. With the permission of the Dean of the Faculty of Graduate Studies and Research, students may register to repeat the course in order to obtain a letter grade. In the circumstances that go beyond the *forty* day period (for example, medical or other special reasons), students may apply for a deferral (refer to Special/Deferred Final Examinations, Section 9.3)

\* *Faik* a notation of F will be assigned to any course in which the student has failed

\* a notation of *Absent* will be assigned to any course in which the student failed to attend the final examination. If the student explains his/her absence (in writing) to the Dean of the Faculty of Graduate Studies and Research within *fourteen* days of that examination, he/she may be granted the privilege of undertaking a special or deferred examination. The notation of *Absent* will also be assigned where a student has terminated a course without formally withdrawing from the course prior to the end of classes; this notation is deemed to be the equivalent of a failure

\* if a thesis, research essay, independent research project, or comprehensive examination is not completed by the end of the period of registration, the notation of *In Progress* may be recorded. The notation *In Progress* may, subject to the approval of the Faculty of Graduate Studies and Research, be used for a research seminar, i.e., a seminar in which students present the results of their thesis research. This notation must be replaced by an appropriate final notation or grade (as specified above) after the thesis, research essay, independent research project, or research seminar has been examined. In cases where a student has registered in a research essay or a thesis without completing it and later undertakes course work to complete the degree program, or loses graduate student status in

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the program, the notation *In Progress* will remain as a permanent entry on the student's record.

### 10.3 Release of Grades

Grades can be accessed through the Touchtone Telephone System for each student as soon as the grades are available after the end of the fall and winter terms of the Fall/Winter session and after the end of the spring session. Transcripts required for professional and graduate schools should be ordered well in advance of any deadline set by these institutions. Students are advised that no official transcripts will be released by the University until all outstanding accounts due have been paid.

## 11. Academic Standing

### 11.1 Qualifying-Year Program

Students should note that admission to the master's program from qualifying year is governed by the admission requirements in Section 2, Admission Requirements and Eligibility.

### 11.2 Master's Program

A grade of B- or better must normally be obtained in each course credited towards the master's degree. A candidate may, with the recommendation of his/her department and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in 1.0 credit. Some departments do not permit the C+ option; students should check carefully to see if the department in question has a B- minimum rule.

#### *\*Full-Time Continuation*

Full-time master's candidates who fail to achieve a weighted GPA of 7.0 after two terms of study, or to maintain it subsequently, will be required to withdraw from the program. In the event of special or extenuating circumstances, the student may apply to the Dean of the Faculty of Graduate Studies and Research for permission to continue in the program.

#### *\*Part-Time Continuation*

A part-time master's student who fails to achieve or maintain a weighted GPA of 7.0 after completing 2.0 credits will be required to withdraw from the program.

### 11.3 Doctoral Program

Doctoral students must normally obtain a grade of B- or better in each course credited towards the degree.

## 11.4 Departmental Evaluation

In addition to the above requirements, departments will undertake a periodic evaluation of a student's progress in his or her overall program of studies and research to determine whether that progress is satisfactory. In the event that progress is deemed unsatisfactory, the department may recommend to the Dean of the Faculty of Graduate Studies and Research that the student be required to withdraw.

## 11.5 Religious Accommodation

Carleton University accommodates students who, by reason of religious obligation, must miss an examination, test, assignment deadline, laboratory, or other compulsory event.

Accommodation will be worked out directly and on an individual basis between the student and the instructor(s) involved. Students should make a formal request to the instructor(s) in writing for alternative dates and/or means of satisfying requirements. Such requests should be made during the first two weeks of any given academic term\*, or as soon as possible after a need for accommodation is known to exist, but in no case later than the penultimate week of classes in that term. Instructors will make reasonable accommodation in a way that shall avoid academic disadvantage to the student.

Students unable to reach a satisfactory arrangement with their instructor(s) should contact the Director of Equity Services. Instructors who have questions or wish to verify the nature of the religious event or practice involved should also contact this officer.

\*When a student's presence is required prior to the date on which classes begin (e.g. For field trips or Orientation activities) any student who cannot meet this expectation of attendance for reasons of religious accommodation should notify the appropriate Faculty Registrarial Services Office in advance.

## 12. Thesis Requirements

Guidelines for the preparation of graduate theses and information on the procedures for examination of graduate theses are available on the World Wide Web at: <http://www.carleton.ca>. This information is also available in the Graduate Student Handbook which is produced jointly by the Faculty of Graduate Studies and Research and the Graduate Students' Association.



## 12.1 General Remarks

The thesis is a major requirement of most programs and, in conjunction with the research for it, makes up at least one half of the time normally required for the program. The thesis must be expressed in a satisfactory literary form, consistent with the discipline concerned, and must display a scholarly approach to the subject and thorough knowledge of it. A critical review of previous work related to the subject should usually be given.

A candidate will not be permitted to submit a thesis for which he or she has previously received a degree; however, with the permission of the Dean of the Faculty of Graduate Studies and Research, he or she may incorporate into the thesis material that was included in a previous thesis.

## 12.2 Master's Thesis

The master's thesis should embody the results of successful scholarly research in a specialized area. It should exhibit the candidate's knowledge of recognized techniques of investigation and critical evaluation, and be presented in an organized and systematic way.

### *\*Oral Examinations*

Candidates are ordinarily required to undertake an oral examination of the thesis. Please refer to Thesis Specifications, Section 12.5, Master's, for submission deadlines. The master's thesis will be examined by a board consisting of at least four members, including the thesis supervisor, the chair of the department concerned, an examiner from a department other than that of the candidate, and one additional member from the department concerned. The chair of the department concerned will announce the constitution of the examining board; both it and the thesis examination process are defined by guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

### *\*Thesis Weight*

Thesis weight (1.0 to 3.0 credits) must be identified at the time of admission. A change in the thesis weight at a later date would require the approval of the Dean of the Faculty of Graduate Studies and Research.

*\*Research Essays and Independent Research Projects*  
Faculty regulations governing research essays and independent research projects are normally the same as those for master's theses, and subject to the guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

## 12.3 Doctoral Thesis

The doctoral dissertation must report, in an organized and scholarly fashion, the results of original research. The thesis must be a contribution to knowledge, and must demonstrate the candidate's ability to undertake sustained research and to present his/her findings in an appropriate manner.

### *\*Oral Examinations*

The thesis must be defended successfully at an oral examination. Please refer to Thesis Specifications, Section 12.5, Doctoral, for submission deadlines. The doctoral thesis will be examined by a board consisting of at least five members, including the thesis supervisor, the chair of the department concerned, an examiner from a department other than that of the candidate, the members of the candidate's advisory committee, the Dean of the Faculty of Graduate Studies and Research or his delegate, and an external examiner who is a recognized authority on the subject of the thesis.

The Dean of the Faculty of Graduate Studies and Research will announce the constitution of the examining board; both it and the thesis examination process are defined by guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

### *\*Thesis Weight*

Thesis weight (ordinarily about half of the total Ph.D. requirements of 10.0 credits) must be identified at the time of admission. If the thesis weight falls within a range of credit weights, it should be assigned at the time of admission a weight corresponding to the lower bounds of that range. A change in the thesis weight at a later date would require the approval of the Dean of the Faculty of Graduate Studies and Research. The work of each Ph.D. candidate will be assisted by an advisory committee of faculty members who will aid the candidate in his/her preparation for the final comprehensive examination, and assist in the evaluation of the thesis and oral examinations.

## 12.4 Deadlines

### *\*Master's Thesis*

A master's student expecting to graduate at the Spring Convocation must submit his/her thesis to his/her supervisor, in examinable form, by *March 1*. A master's student expecting to graduate at the Fall Convocation must submit his/her thesis by *August 1*. A master's student expecting to graduate at the Winter Graduation must submit his/her thesis by *December 1*.



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### *\*Doctoral Thesis*

A Ph.D. student expecting to graduate at the Spring Convocation must submit his/her thesis to his/her supervisor, in examinable form, by March 1. A Ph.D. student expecting to graduate at the Fall Convocation must submit his/her thesis by August 1. A Ph.D. student expecting to graduate at the Winter Graduation must submit his/her thesis by December 1.

## 12.5 Specifications

\* The candidate must submit six printed copies (original and five acceptable duplicated copies, on bond paper) and must comply with the special departmental requirements governing the form of the thesis, including methods of bibliographical entry and the use of diagrams and tables.

\* Each thesis must be accompanied by a suitable abstract. The abstract of a master's thesis should not exceed 150 words, while the abstract of a doctoral thesis may be up to 350 words in length.

\* Regulations regarding style, pagination, certification, acceptance, grade and size of paper, as well as abstracts, reproduction, microfilming, binding, and the constitution of the examining board will be prescribed by the Faculty of Graduate Studies and Research.

### *\*Master's Thesis*

The candidate is expected to notify his/her supervisor and the chair of the department at least two weeks in advance of the date on which he/she intends to submit the completed thesis. The candidate is then expected to submit six copies of the completed thesis to the department at least four weeks in advance of the intended date of examination. The thesis examination and defence will then be scheduled and the date will be announced at least two weeks in advance. The department must deposit one copy of the thesis to the office of the Faculty of Graduate Studies and Research at least two weeks in advance of the actual date for the examination and defence.

### *\*Doctoral Thesis*

The candidate is expected to notify his/her supervisor and the chair of the department at least two weeks in advance of the date on which he/she intends to submit the completed thesis. The candidate is then expected to submit six copies of the completed thesis to the department at least six weeks in advance of the intended date of examination. The thesis examination and defence will then be scheduled and the date will be announced by the Dean of the Faculty of Graduate Studies and Research at least four weeks in advance. The department must deposit one copy of

the thesis to the office of the Faculty of Graduate Studies and Research at least four weeks in advance of the actual date for the examination and defence.

\* Five unbound copies of the approved thesis, the original and four others, should be submitted for binding to the Faculty of Graduate Studies and Research. Each copy must be presented in order of pagination in a separate envelope. Two copies are maintained in the library, the third copy is given to the department, the fourth copy is for the candidate, and the fifth copy is for the thesis supervisor. If the thesis was supervised by two faculty members, the Faculty of Graduate Studies and Research will accept six unbound copies.

## 12.6 Licence to the University and to the National Library of Canada

In the interest of facilitating research by members of the Carleton community and by interested outsiders, and in consideration of his/her having been accepted as a graduate student at Carleton, the student author of a thesis or dissertation submitted in partial fulfillment of the requirements for an advanced degree shall grant to the University and to the National Library of Canada a license to make single copies or microfilms, solely for the purpose of private study and research, in response to written requests from individuals, libraries, universities, or similar institutions.

It is understood that the student author retains other publication rights, and that neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

## 12.7 Withholding of Thesis Deposition

If, at the time of submitting his/her thesis, the student elects to protect any rights to immediate commercial publication, or to obtain a patent which may arise from his/her research, or to keep his/her thesis out of circulation for other reasons, he/she may apply in writing to the Dean of the Faculty of Graduate Studies and Research requesting that the thesis be withheld from deposit in the library:

\* for an additional period of three months, without reason

\* for each additional period of six months, with reason (total period of restriction not to exceed two years)

The student must submit any request for extension of the restriction one month prior to the termination of the previous period. The student and his/her supervisor will be re-

quired to justify the extension of the restriction. Subsequent requests must follow the same procedure.

### 13. Time Limits for Program Completion

#### 13.1 General Remarks

There are maximum time limits for the completion of programs. Candidates may also be subject to time constraints prescribed by individual departments to ensure orderly progress through the stages of their programs.

#### 13.2 Master's Program

##### *\*Full time*

Full-time master's candidates must complete their degree requirements within six terms of registered full-time study. Students admitted to a 10.0 credit master's program (that is, in the School of Public Administration, the School of Journalism and Communication, and the School of Social Work) must complete their degree requirements within nine terms of registered full-time study.

##### *\*Part time*

A part-time master's candidate must complete his/her degree requirements within an elapsed period of six calendar years after the date of initial registration. Students admitted to a 10.0 credit master's program (that is, in the School of Public Administration, the School of Journalism and Communication, and the School of Social Work) must complete their degree requirements within an elapsed period of eight calendar years after the date of initial registration.

##### *\*Combined Full Time and Part Time*

A master's candidate who elects to complete his/her program by a combination of full-time and part-time study is governed by the following elapsed-time limitations: five calendar years if the candidate is registered as a full-time student for two or three terms and part-time for the balance; four calendar years if the candidate is registered for four or five terms as a full-time student and part-time for the balance.

These limitations are calculated from the date of initial registration in the master's program.

##### *\*Combined Full-Time and Part-Time in 10.0 credit Master's Programs in the School of Public Administration, the School of Journalism and Communication, and the School of Social Work*

A master's candidate who elects to complete his/her program by a combination of full-time and part-time study must complete the degree requirements within an elapsed period of eight calendar years after the date of

initial registration in the master's program.

#### 13.3 Doctoral Program

##### *\*Full Time*

A full-time Ph.D. candidate who is admitted on the basis of a master's degree (that is, with a program of 10.0 credits or the equivalent) must complete the Ph.D. degree requirements within an elapsed period of six calendar years after the date of initial Ph.D. registration.

##### *\*Part Time*

A Ph.D. candidate who undertakes the program by a combination of full-time and part-time study must complete the degree requirements within an elapsed period of eight calendar years after the date of initial registration in the Ph.D. program.

#### 13.4 Exemption from Time Limit

When exemption from registration for a term or terms has been approved by the Dean of the Faculty of Graduate Studies and Research, this period will be exempt from the overall time limit allowed for completion of the program. A charge of \$50.00 per term of exemption from the time limit must accompany each request.

#### 13.5 Extension of Time Limit

In exceptional cases, an extension of time permitting further registration (one or two terms) may be granted to a candidate whose recent progress, as judged by the department, has been otherwise satisfactory. Requests for extension of time should be directed to the Dean of the Faculty of Graduate Studies and Research through the department concerned.

A charge of \$50 per term of extension beyond the normal time limit must accompany each request.

#### 13.6 Grade Review

Within two weeks of the release of grades or the announcement of comprehensive examination results or thesis results, a graduate student may request, through the Dean of the Faculty of Graduate Studies and Research, that one or more of his/her grades or results be reviewed. The charge for such a review is \$50, which must accompany the review request. *Note:* The review process will not take place if the fee is not remitted. If the grade is raised, the \$50 charge is refundable.

#### 13.7 Program Review

A graduate student has the right to request a review of decisions made concerning his/

her graduate status or any other ruling relating to his/her program. All such requests are to be made in writing to the Dean of the Faculty of Graduate Studies and Research.

### 13.8 Records Retention Policy

Since 1990 the University has implemented a records retention policy which provides for the destruction of student file folders and their contents after a period of ten years has elapsed since the last registration. This policy applies to those students who are formally admitted and registered in degree programs. Further information on this policy can be obtained by contacting the Faculty of Graduate Studies and Research.

## 14. Instructional Offences

### 14.1 Regulations

The Senate of the University has enacted the following regulations for instructional offences at the graduate level:

Any student commits an instructional offence who:

(a) cheats on an examination, test, or graded assignment by obtaining or producing an answer by deceit, fraud, or trickery, or by some act contrary to the rules of the examination

(b) submits substantially the same piece of written work to two different courses. Minor modifications and amendments or changes of phraseology do not constitute a significant and acceptable reworking of an essay or paper

(c) contravenes the regulations published at an examination or which are displayed on the reverse side of a properly authorized examination booklet

(d) commits an act of plagiarism. Plagiarism will be deemed to have occurred when a student either:

(i) directly copies another's work without acknowledgement; or

(ii) closely paraphrases the equivalent of a short paragraph or more without acknowledgement; or

(iii) borrows, without acknowledgement, any ideas in a clear and recognizable form in such a way as to present them as the student's own thought, where such ideas, if they were the student's own, would contribute to the merit of his or her own work

(e) disrupts a class or other period of instruction if he or she:

(i) is a registered member of the class or period of instruction

(ii) is warned to discontinue any act or behaviour reasonably judged by the instructor of the course or period of instruction to be detrimental to the class, and having ignored such warning is ordered by the instructor to leave and refuses to leave

(f) Any student found in violation of these regulations may be:

(i) expelled

(ii) suspended from all studies at the University

(iii) suspended from full-time studies; and/or

(iv) awarded a reprimand

(v) refused permission to continue or to register in a specific degree program, but subject to having met all academic requirements shall be permitted to register and continue in some other program

(vi) placed on academic probation

(vii) awarded a Fail or Absent in a course or examination

Allegations of instructional offence may be investigated by instructors and/or departmental chairs and, in all cases, will be reported to the faculty dean. The dean will promptly advise, in writing, the student and the University Ombudsman of the allegation and of the student's rights. The dean will review the allegation and if not resolved at that level, the allegation becomes subject to final disposition by a tribunal appointed by the Senate. Information about procedure governing tribunals is available from the Clerk of the Senate, Room 607, Robertson Hall.

## 15. Offences of Conduct

### 15.1 Conduct Offences

The University has in place regulations and procedures to deal with allegations of misconduct made against students in the areas of discrimination and sexual harassment.

### 15.2 Discrimination

The University has enacted the following regulation:

Any student commits a general offence who commits an act of discrimination on the basis of race, ancestry, place of origin, colour, ethnic origin, national origin, creed, sex, age, marital status, family status, political affiliation or belief, sexual orientation, or any handicap that



is defined as such in the Human Rights Code of Ontario.

The University has also approved the following procedures for enforcement of this regulation:

1. An allegation shall be made in writing to the Dean of the Faculty in which the program to which the respondent has been admitted belongs or, in the circumstances where the respondent has not been admitted to a program, to the Dean of the Faculty where the majority of courses in which the respondent has registered are administered. An allegation against a student in residence when made by another student in residence which involves the complainant's enjoyment of her/his accommodation shall be made to the Vice-President (Academic).

The Dean or the Vice-President (Academic), as the case may be, shall cause to have an investigation conducted and, upon receipt of the report of the investigation, shall either

- (a) dismiss the allegation on the grounds of insufficient evidence or lack of jurisdiction by the University, or
- (b) accept that the allegation is founded and seek the agreement of the respondent to a remedy, or
- (c) refer the matter to the President

A dean's dismissal of the allegation may be appealed, within ten working days, to the Vice-President (Academic) who may, in turn, either

- (a) again dismiss the allegation, or
- (b) accept that the allegation is founded and propose a remedy to the respondent, or
- (c) refer the matter to the President

In the case of students in residence, where the original allegation has been made to the Vice-President (Academic) and is dismissed, appeal shall be directly to the President who may either

- (a) again dismiss the allegation, or
- (b) accept that the allegation is founded and propose a remedy to the respondent, or
- (c) refer the matter to a tribunal appointed by the Senate

2. In the instance where the matter has been referred to the President, the latter shall decide whether or not the University shall conduct a hearing before a tribunal appointed by the Senate.

If the allegation is proven, the tribunal shall decide upon one of the following sanctions:

The student may be:

- (a) expelled
- (b) suspended for a period of time from all studies at the University
- (c) restricted in his/her use of University facilities; and/or
- (d) given a reprimand

Should the President decide not to conduct a hearing before a tribunal, the allegation shall be deemed to have been dismissed, but the President shall give written reasons for such a decision, and these reasons shall be communicated to the parties involved.

3. In the instance where the complainant wants redress from the University without the involvement of the respondent, or where the respondent is unknown or is not a member of the university community, and/or where there is a claim that the University has failed or has been negligent in providing a safe, non-hostile environment, the allegation of an offence shall be made in writing to the President, who shall cause an investigation to be conducted. Upon receipt of the report of the investigation, the President may order any relief he/she deems fit, and shall give written reasons for the decision, which reasons shall be communicated to the complainant.

Information about procedure governing tribunals is available from the Clerk of the Senate, Room 607, Robertson Hall.

### 15.3 Sexual Harassment

The University has approved a Sexual Harassment Policy which defines sexual harassment as follows:

1. Sexual harassment may occur irrespective of gender and is:

(a) unwanted attention of a sexually oriented nature, made by a person who knows or ought reasonably to know that such attention is unwanted;

and/or

(b) an implied or expressed promise of reward for complying with or submitting to a sexually oriented request or advance; and/or

(c) an implied or expressed threat or reprisal for not complying with or submitting to a sexually oriented request or advance

Sexual harassment may include, but may not be limited to, behaviour such as

\* unwarranted touching



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\* suggestive remarks or other verbal abuse in a sexual context

\* leering

\* compromising invitations

\* demands for sexual favours

\* sexual assault

2. Sexual harassment may also be engaging in a course of sexual comment or conduct that is known or ought reasonably to be known to be unwelcome. This form of sexual harassment may affect individuals or groups. It may take the form of excluding an individual or a group from rights and/or privileges to which they are otherwise entitled.

3. Sexual harassment may be psychological, verbal, or physical, and may be all of these. It is behaviour prohibited by the University for all persons and circumstances over which the University has jurisdiction. In some of its forms it may contravene the Human Rights Code of Ontario. Sexual assault is a crime pursuant to the Criminal Code.

4. Regulations governing the conduct of students and employees of the University are applied to those times and places at which the actions of such employees and students relate to or impinge upon their function as such.

The University's sexual harassment policy provides for advisory and mediation services to assist in resolving perceived situations of sexual harassment before they reach the level of formal allegation. Attention is drawn, in this regard, to the role of the University's Adviser on Sexual Harassment complaints. The advisor may be contacted at 520-5622, Equity Services.

The University has enacted regulations under which allegations of general offence (sexual harassment) may be made against students. These regulations state that a student commits a general offence who engages in conduct which constitutes sexual harassment as defined in the University's sexual harassment policy.

The University has also approved procedures for the handling of allegations of general offence (sexual harassment) against a student. These procedures, as well as the sanctions which a tribunal can impose, are the same as those outlined above for acts of discrimination, save and except that the investigators charged with the investigation which the Dean, the Vice-President (Academic), or the President, as the case may be, shall cause to have conducted, must be selected from the Panel

of Investigators provided for under the terms of the University's sexual harassment policy.

## 16. Appeals and Petitions

### 16.1 Criteria and Procedures

Assuming that a graduate student has exhausted all avenues of appeal and petition with the Dean of the Faculty of Graduate Studies and Research (questions regarding the appeals process can be directed to the Office of the Dean at 520-2518), a graduate student may appeal the decision of the University to deny the award of degree or the required withdrawal of the student to the Senate upon certain specific grounds.

Such grounds are the allegation by the student that the student has been denied a degree or forced to withdraw because of some mistake, error, or improper conduct by the University, its officers, or employees.

A graduate student may petition the Senate to grant a degree or to stay a decision of required withdrawal on compassionate grounds.

Such appeals and petitions must be submitted in writing, within ninety days of receipt by the student of the decision which is to be appealed or petitioned, to the Clerk of the Senate, Room 607, Robertson Hall.

## 17. Graduation

### 17.1 Conferring of Degrees

On the recommendation of the Faculty of Graduate Studies and Research and with the approval of the Senate of the University, degrees are conferred by the Chancellor in the spring and fall of each year.

### 17.2 Application Deadlines

Candidates may have their degrees certified in February each year; they must apply by *December 1*. Students expecting to graduate at the Spring Convocation must apply for graduation in the Graduate Studies and Research office by *February 1*. Those expecting to graduate at the Fall Convocation must apply by *September 1*.

## 18. Engineering

In addition to University and Graduate Faculty Regulations, all Engineering departments share the following procedures.

Programs of study are offered by the Faculty of Engineering leading to the degrees of Master of Engineering and Doctor of Philosophy in Aerospace, Civil, Electrical, and Me-

chanical Engineering; to the degree of Master of Engineering in Materials Engineering, and Telecommunications Technology Management; and, in cooperation with the Faculty of Science, to the degree of Master of Science in Information and Systems Science.

Most graduate programs in the engineering departments at Carleton University and the University of Ottawa are administered through joint institutes in three engineering disciplines. The Ottawa-Carleton Institute for Electrical and Computer Engineering was established in 1983; for Mechanical and Aerospace Engineering in 1984; and for Civil Engineering in 1984. Each of these institutes combines the research strengths and resources of departments of engineering at Carleton University and at the University of Ottawa, and provides a framework for interaction. The institutes are also concerned with applications for graduate programs and graduate course offerings.

Programs leading to master's and Ph.D. degrees are available through the institutes in a wide range of sub-disciplines in each department.

The areas of current research, the research facilities available, and the graduate courses offered are given in the following pages for the four departments of the faculty:

- \* Civil and Environmental Engineering
- \* Electronics
- \* Mechanical and Aerospace Engineering
- \* Systems and Computer Engineering

Both the master's and Ph.D. programs may be undertaken on a full-time or part-time basis.

General information on awards and financial assistance is given in that section of this Calendar.

A limited number of students who are not degree candidates may be admitted to each graduate engineering course. Credit earned as a special student normally cannot be credited towards a graduate degree in engineering.

### 18.1 Computing Facilities

Computing facilities available to engineering students include the university's central Honeywell mainframes with time-sharing terminals. In addition, two VAX minicomputers, numerous SGI, SUN, and Apollo workstations, and many microcomputers reside in the engineering departments. Several other computers within the Faculty are in use for data acquisition and specific research projects.

### 18.2 Research in an Outside Institution

A student may apply for permission to carry out his/her research, in part or whole, in an outside institution (for example, industrial, governmental, or university laboratory). Such an application, addressed to the Dean of the Faculty of Graduate Studies and Research through the Dean of Engineering and Design, should:

- \* Include a detailed statement of the research proposal, of arrangements for supervision, and of the circumstances under which it is to be carried out
- \* Establish that the applicant will be able to pursue independent research
- \* State the facilities available for the research
- \* Include a proposed time schedule
- \* Be accompanied by a supporting letter from a responsible person in the outside institution giving approval of the proposal and accepting these regulations

### 18.3 Part-time Thesis Research

A part-time research program may be permitted if the conditions for the "presence" of the student (outlined under faculty regulations) are satisfied. It is the responsibility of the research supervisor to define the fraction of full-time research engaged upon by the student so that this can appropriately be credited to his/her program and assessed for payment of tuition fees. Before permission to undertake research on a part-time basis can be granted, the student must submit in writing, to the Dean of the Faculty of Graduate Studies and Research through the Dean of Engineering and Design, a statement of his/her proposed manner of working part time, supported by a letter of approval from his/her employer.

### 18.4 Waiver of Thesis

A candidate for the master's degree who has, before admission, completed independent research or development projects of an adequate level of accomplishment, may apply to the chair of the department concerned for a waiver of the thesis requirement. Such application must be made at the time of initial registration, and must be supported by copies of published reports describing the work. If the application is approved, the candidate must complete ten 0.5 credits, six of which must be graduate-level courses in engineering, to fulfill the requirement for the award of a degree without a thesis. A candidate who has been granted a waiver of the thesis require-

## General Regulations

ment may be required to take an oral examination on the subject of one of his/her published papers and topics related to his/her field of specialization.

### 18.5 Transfer of Credit

Normally, 1.0 credit completed at another university may be accepted in partial fulfillment of degree requirements, provided that the course is appropriate to the candidate's program at Carleton University. Under special circumstances, a second 1.0 credit may be allowed. Refer to the General Regulations section of this Calendar for details of the rules governing transfer of credit (see p. 53).

### 18.6 Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance and demonstrates high promise for advanced research during the full-time master's program at Carleton University may, subject to meeting the requirements below, and with the approval of the admissions committee of the joint institute administering his/her graduate program, be permitted to transfer into the Ph.D. program without receiving the master's degree. Such a student must complete the course requirements and thesis registration requirements of the master's program, but is exempted from submission of the thesis.

A student wishing to transfer should apply to the chair of his/her department. If the department and the Faculty of Graduate Studies and Research approve the application, the candidate will be required to take the comprehensive examination for the Ph.D. The requirements for the comprehensive examination will include the submission of a report on research to date, and a research proposal for the Ph.D.

After successfully passing the comprehensive examination, the student will be admitted to the Ph.D. program with normal program requirements (but with the comprehensive examination to his/her credit). If unsuccessful, he/she will remain in the master's program and be required to submit the thesis in the usual way.

### 18.7 Faculty Regulations

Graduate students in the Faculty of Engineering are governed by the section of this Calendar entitled General Regulations, and by the regulations stated in this section.

All graduate students in the Faculty of Engineering must obtain satisfactory grades in their

course work, must make satisfactory progress in their research if a thesis is included in their program, and must satisfy the following criteria of activity or "presence" in the program:

- \* Maintain a close working relationship with their research supervisor

- \* Attend the courses for which they are registered

- \* Submit written reports and present seminars as required by their supervisor

- \* Attend departmental seminars held regularly to discuss current research and related topics. Each student is required from time to time to present a seminar on his/her research; part-time students who are not actively engaged in research are exempt from the seminar requirement

- \* Be readily available on an informal basis

### 18.8 Thesis Regulations

The thesis must represent the result of the candidate's independent research or development work, undertaken after admission to graduate studies at Carleton University. Experimental or theoretical results previously published by the candidate may be used only as introductory or background material for the thesis. A candidate may be permitted to carry on thesis research work off campus, provided that the work is approved in advance, and arrangements have been made for supervision of thesis research activities by a faculty member of Carleton University. A part-time student may use the Faculty of Engineering laboratory facilities for on-campus thesis research and development activities.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of the thesis and related fields.

### 18.9 Registration and Course Selection

- \* Undergraduate engineering courses may not normally be taken for credit.

- \* All students require departmental approval for their program of studies, for course registration, and for any changes to their status or program.

- \* Each full-time student is required, in any fall or winter program requirements of three or more 0.5 credit courses, to register for credit in at least three 0.5 credit courses. After the last day for withdrawal from courses in each such term, the student must remain registered in at least three 0.5 credit courses.



\* For part-time students, the department will arrange the appropriate course load and selection.

## 18.10 Master of Engineering

### Admission Requirements

Applicants are admitted under the general regulations specified in this Calendar, but, in addition, are required to have strong undergraduate preparation in the appropriate engineering disciplines, computer programming, mathematics, and physics.

### Program Requirements

Two alternatives are available for full-time students studying towards the degree of Master of Engineering, one involving a thesis plus course work, the other involving course work only. The choice of these alternatives must be arranged and approved at the time of admission into the program. Students are encouraged to take at least 0.5 credit outside of their department.

#### *M.Eng. by Thesis*

- \* A thesis based on the student's research
- \* A minimum of 3.0 credits in engineering or a related discipline. The number of credits required by each department is specified in its section of this Calendar

#### *M.Eng. by Course Work*

Specific program requirements are detailed in the departmental sections of this Calendar.

## 18.11 Ph.D. In Engineering

### Admission Requirements

For admission to the Ph.D. program, an applicant must normally hold a master's degree in engineering (or its equivalent) and, by his/her previous program of study and scholastic record, demonstrate a capacity for advanced study and research. Experience gained while working in an engineering or research environment will be taken into account when assessing an application. The applicant must specify his/her intended field of research.

### Program Requirements

The specific program requirements for the Ph.D. degree are the following:

- \* A minimum of two calendar years of full-time study (or the equivalent)

\* Course requirements as established on admission, but not less than the minimum requirements as stated in each joint program Institute section of this Calendar. Students should note that the minimum number of credits required in the Ph.D. program varies among the joint Institutes. Subject to approval of the student's adviser or advisory committee, the student may take, or be required to take, courses in an appropriate discipline outside the Faculty of Engineering. For information on admission and program requirements for the Departments of Electronics (see p. 155), Mechanical and Aerospace Engineering (see p. 248) and Systems and Computer Engineering (see p. 329).

\* Substantial research

\* A thesis on the research

### Advisory Committee

An advisory committee with at least three members will be appointed by the department soon after a student's first registration. It has the responsibility of ensuring that conditions for the pursuit and completion of the student's program are fulfilled, and it reviews his/her program at least once a year.

### Comprehensive Examination

The comprehensive examination is held approximately one year after initial registration in the program in the case of full-time students, and at an equivalent time in the case of part-time students. The purpose of the examination is threefold:

- \*To assess the student's comprehensive knowledge of his/her field of study
- \*To assess the preparedness and capability of the student for doctoral research
- \*To judge the suitability of the research topic for a doctoral thesis

The student is required to present his/her research proposal, and to be subjected to oral and written examination in appropriate fields of study. He/she will be informed by the advisory committee of the specific requirements of the examination. Having successfully completed the comprehensive examination, the student becomes a doctoral candidate.



## Academic Programs, Units and Courses

- Architecture
- Art History
- Biology, Ottawa-Carleton Institute
- Biostatistics, Collaborative Program
- Business
- Canadian Studies
- Chemistry, Ottawa-Carleton Institute
- Chemical and Environmental Toxicology, Collaborative Program
- Civil and Environmental Engineering
- Civil Engineering, Ottawa-Carleton Institute
- Cognitive Science
- Comparative Literary Studies
- Computer Science
- Computer Science, Ottawa-Carleton Institute
- Economics
- Electrical and Computer Engineering Ottawa-Carleton Institute
- Electrical Engineering University of Ottawa
- Electronics
- English Language and Literature
- European and Russian Studies
- Film Studies
- French
- Geography
- Geoscience, Ottawa-Carleton Centre
- German
- History
- Industrial Design
- Information and Systems Science
- Interdisciplinary Studies
- International Affairs
- Journalism and Communication
- Law
- Linguistics and Applied Language Studies
- Mass Communication
- Mathematics and Statistics, Ottawa-Carleton Institute
- Mechanical and Aerospace Engineering
- Mechanical and Aerospace Engineering, Ottawa-Carleton Institute
- Mechanical Engineering, University of Ottawa
- Music
- Neuroscience
- Philosophy
- Physics, Ottawa-Carleton Institute
- Political Economy
- Political Science
- Psychology
- Public Administration
- Religion
- Social Work
- Sociology and Anthropology
- Spanish
- Women's Studies

## Architecture

Architecture Building 202  
Telephone: 520-2855  
Fax: 520-2849

### The School

**Director of the School**, Benjamin Gianni

**Supervisor of Graduate Studies**, Martin Bressani

The School of Architecture offers a program of graduate studies leading to the degree of Master of Architecture (Design Studies).

Students are admitted to the program on the basis of a first professional degree in Architecture, evidence of undergraduate studies in the humanities, and a portfolio of creative and scholarly work demonstrating academic and architectural design abilities. Professional experience may be taken into consideration. The School admissions committee will consider applications from candidates in related design disciplines on the basis of professional work, academic experience, and the demonstration of design ability. The M.Arch. (Design Studies) is a post-professional, research-oriented degree, not a professional one.

The program is research and/or studio-based with students expected to do a research and/or design thesis. The emphasis in both the thesis and graduate seminar is on the cultural grounding of architectural design as investigated in both scholarly investigations and in the design studio. Graduate level studio work is conducted as both intellectual inquiry and practical application. Design theses are expected to include both a written text and appropriate modes of two-dimensional or three-dimensional representation. As far as possible, within the limits of this framework and the resources of the program, the particular interests of individual students will be encouraged.

Students may pursue studies in the following fields.

#### *Theoretical Issues in Architecture and Culture*

Theoretical issues cluster around three axes:

- \* literature on the theory of culture
- \* architectural theory
- \* the use of architectural design as a form of research

Drawing upon the above, students investigate how the patterns and interrelationships of cultural issues and processes manifest themselves in and inform architectural design.

#### *Architecture and Cultural Diversity*

The contemporary multicultural ideal, that a broad diversity of cultural identities and ethnicities should be supported by all means available to us, is the focus of this area of the program. Students address the question of how, and to what extent, architectural design can actively support cultural identity while promoting a diversity of identities at the local, national, and global scale. Canada provides a uniquely favourable setting for such an investigation.

#### *Architecture and Techno-Scientific Culture*

Electronic technologies and screen-based interfaces extend and challenge traditional modes of visual expression. Simulated realities, expert systems, electronic modelling, visualization, and CAD applications open infinite possibilities in visual, written and interactive communications. Moreover, the convergence of data as digital information allows for an unprecedented mixing and integration of media.

#### *Design and Technology*

The Design and Technology area of the program addresses the need to engage technically-advanced tools in design studies and to bring design expertise to bear on new media, interfaces, software and technology products. The design or environments has long been the purview of architects; the Design and Technology specialization brings principles of architectural and graphic design to bear on virtual spaces, environments and graphic interfaces. To this end, the Design and Technology stream provides its own core courses and multimedia workshops (see below) offered in conjunction with the Schools of Industrial Design and Computer Science.

### Qualifying-Year Program

Candidates with deficiencies in certain areas may be required to take additional prescribed courses as prerequisites to their graduate work. Applicants who do not possess a professional degree in Architecture may be required to register in the qualifying-year program (normally 5.0 credits at the 400-level). All courses must be approved by the graduate admissions committee of the School in consultation with the Faculty of Graduate Studies and Research. Upon successful completion of these courses, students may be permitted to proceed to the M.Arch. (Design Studies) program.

### Master of Architecture

#### Admission Requirements

The normal requirement for admission to the M.Arch. (Design Studies) program is a profes-

sional degree in architecture. Where applicants do not possess such a degree but possess either a professional degree in a related discipline such as industrial design or landscape architecture, a master's degree, or an Honours B.A. degree with high standing (minimum B+ average), equivalency will be considered on the basis of professional work, academic experience, and the demonstration of architectural design ability. Applicants must also have successfully completed courses at the undergraduate level in cultural disciplines. This may include appropriate course work from the humanities, fine arts, or social sciences, or the equivalent.

Applicants are required to submit a portfolio of design, graphic, or fine arts work, together with sample research papers or other written material in the cultural disciplines. The portfolio must be judged to be sufficient to document adequate preparation for success in the program.

Applicants must also provide two confidential letters of reference on the prescribed forms and a statement of academic and career objectives. Application is made on the forms available from the office of graduate studies in the School of Architecture.

An admissions committee, which includes the supervisor of graduate studies, will determine the merits of each candidate on the basis of academic record, evidence of visual and architectural design ability, and, where applicable, professional experience. Enrolment is limited.

The Faculty of Graduate Studies and Research requires applicants whose native tongue is not English to be tested for proficiency in English, as described in Section 3.6 of the General Regulations (see p. 52.) Applicants must have an ability to write in English.

The deadlines for submission of applications for graduate studies in Architecture are as follows: March 1 for students requesting financial assistance; June 1 for students who are not seeking financial assistance but who are seeking admission in September; October 1 for students who are seeking admission in January.

### Program Requirements

The program requirements for master's candidates are as follows:

- \* 3.0 credits
- \* A thesis equivalent to 2.0 credit which must be defended at an oral examination

At least 4.0 of the 5.0 credits required for the master's program must be at the 500-level or above except for students in the *design and technology stream* who must complete 4.5 credits at the 500-level or above. A list of theory, elective and cultural theory courses which may be used for credit is available from the School of Architecture. All courses must be approved by the supervisor of graduate studies.

The program will normally be completed in three terms of full-time study.

Students enrolled in the *Theoretical Issues in Architecture* and *Culture and the Architecture and Cultural Diversity* streams are required to successfully complete the following:

- \* Architecture 76.501 and 76.502 (1.0 credit)
- \* Architecture 76.503 (0.5 credit)
- \* 0.5 credit in the area of architectural theory (an advanced course at the 400-level in the theory of architecture offered by the School)
- \* 0.5 credit in the area of cultural theory (a course at the 500-level or above in the general field of cultural theory)
- \* 0.5 credit elective chosen from an approved list of courses in the area of cultural studies, cultural theory, cultural production, the built environment and related subjects
- \* Architecture 76.599

Students enrolled in the *Design and Technology* stream are required to successfully complete the following:

- \* Architecture 77.501 and 77.502 (1.0 credit)
- \* Architecture 79.511 (1.0 credit)
- \* Architecture 79.512 (0.5 credit)
- \* A total of 0.5 credit of electives chosen from an approved list of courses in the area of culture and technology which may be at the 400- level, as approved by the Graduate Supervisor.
- \* Architecture 77.599

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.



Qualified students in other departments may, with permission of the School, enrol in Architecture 76.501, 76.502, 76.503, 77.501, 77.502, 79.511 and 79.512

#### Architecture 76.501F1

##### **Architecture Seminar 1**

An exploration of the intellectual frameworks which connect design and culture as manifest in theories of culture and theories of architecture and design, including a discussion of design as research through the study of work manifesting a strong theoretical animation. The seminar builds on previous undergraduate studies in culture and studio work in design, and is not intended as an introduction to these fields. The field of inquiry will be both historical and contemporary, and will utilize both western and non western examples. Faculty from units other than Architecture are involved in some of the session. This initial seminar concentrates on broad general frameworks covering the subject areas of culture and design.

#### Architecture 76.502W1

##### **Architecture Seminar II**

A continuation of Architecture 76.501, this seminar follows the same general description, but concentrates more on architectural design, on the contemporary condition, and on the ways of thinking that characterize embodiment of cultural content in architecture and other artifacts.

#### Architecture 76.503W1

##### **Design and Culture Workshop**

The prime objective of the workshop is experimental: to provide an opportunity to investigate cultural issues in architectural design. The workshop operates as a directed studies in which to explore a theoretical issue.

#### Architecture 76.599F4, W4, S4

##### **Master of Architecture (Design) Thesis**

The thesis requirement for the M.Arch. is a Design Thesis, written in conventional thesis form and supported by the models and drawings that normally document architectural design. Topics are proposed by the student and must be approved by the graduate committee of the School of Architecture. Theses develop around questions of a cultural nature, demonstrate a capacity to conduct design as research on a theoretical level, and reach conclusions in terms of new design knowledge. Theses must be defended before an interdisciplinary panel representing other graduate programs and institutions as well as faculty from the School of Architecture.

#### Architecture 77.501F1

##### **Introduction to Design and Multimedia**

An introduction to the broad field of multi-

media and interactive design as it relates to architecture and the general field of design. Special topics include virtual environments, user interface in software, web and product design, perceptual and cognitive science, navigation, film/videosound editing and animation technologies.

#### Architecture 77.502W1

##### **Topics in Multimedia**

Introduction to multimedia programming (HTML, Java, VRML and Lingo) and the technical aspects of emerging software. Through specific exercises, students will augment and customize various software applications introduced in 79.511.

#### Architecture 77.599F4, W4, S4

##### **Design and Technology Thesis**

Basic or applied research in architectural, industrial, and digital design. Areas include interactive education/training, product/interface design, programming/scripting, culture/technology, or research as defined by the student.

#### Architecture 79.511F2

##### **Interactive Design Workshop I**

Introduction to the design of interactive environments. Evaluation of multimedia software and authoring programs (Macromedia Director, Authorware, Pagemill, Premiere, Persuasion Photoshop, Form Z, and 3-D Studio) and HTML scripting. Basic design, graphic design and software literacy.

#### Architecture 79.512W1

##### **Interactive Design Workshop II**

An introduction to the design and multimedia products with an emphasis on user interface design and conceptual product development. Topics include user-centered design; information architecture including graphic treatment and sound; navigation development and metaphors; usability testing and prototype development; project management and presentation.

### **Other Course Offerings**

In addition to the M.Arch. program, the School offers graduate-level courses which can be used towards a degree program in the Faculty of Engineering, the School of Canadian Studies, and the Faculty of Public Affairs and Management. There is also an understanding with the Faculty of Environmental Studies at York University, the Centre for Building Studies at Concordia University, and the Faculté de l'Aménagement at the Université de Montréal, that a student registered in their program can apply for permission to do a certain part of the graduate work through course offerings made at the Carleton School of Architecture.



## Architecture

Members of the School also supervise graduate research.

The interests and capabilities of the faculty members lie in the following areas:

### *History and Theory of Architecture*

Scholarly studies in architectural thought from renaissance to modern movement, current debate and contemporary issues; Canadian architecture; Mayan architecture; Islamic architecture.

### *Architecture and Society*

Ethnicity, multiculturalism and architectural expression; international development and indigenous architecture; heritage and preservation; evolution of the architecture profession.

### *Architecture and Technology*

Building envelope and construction detail; design economics; structures; energy; lighting; acoustics; integration of systems.

### *Architecture and the City*

Urban morphologies, architectural content of urban planning and design; social, cultural, economic, and political matrix in the urban society and the contemporary architectural reality.

### *Computer-Aided Design and Management*

Design and modelling, visual communication, computer graphics; computers and architectural practice.

### *Architecture and Morphology*

Studies in form, space, structure, and order; geometric and symbolic orders in architecture.

An Honours degree or equivalent qualification in a relevant field, as well as permission of the School, is a requirement for registration in the following courses.

Architecture 76.500F1, W1

### **Directed Studies in History and Theory of Architecture**

Reading and research tutorials.

Architecture 76.510F1, W1

### **Directed Studies in Architecture and Society**

Reading and research tutorials.

Architecture 77.500F1, W1

### **Directed Studies in Architecture and Technology**

Reading and research tutorials.

Architecture 77.541F1, W1, S1

### **Workshop: Technical Studies in Heritage Conservation.**

(Also listed as Canadian Studies 12.541)

Architecture 78.500F1, W1

### **Directed Studies in Architecture and the City**

Reading and research tutorials.

Architecture 78.542F1, W1, S1

### **Workshop: Urban Studies in Heritage Conservation**

(Also listed as Canadian Studies 12.542)

Architecture 79.500F1, W1

### **Directed Studies in Computer-Aided Design**

Reading and research tutorials.

Architecture 79.501F1, W1

### **Directed Studies in Architecture and Morphology**

Reading and research tutorials.

# School for Studies in Art and Culture: Art History

St. Patrick's Building 423  
Telephone: 520-2342  
Fax: 520-3575

## The School

Director, Bryan Gillingham

Supervisor of Graduate Studies, Angela Carr

The School for Studies in Art and Culture offers a program of study and research leading to the degree of Master of Arts in Canadian Art History. The program is unique in its breadth and comprehensiveness. Students can choose to focus on art and architecture drawn from Canada's wealth of different artistic communities, including the traditions of Euro-Canadians, aboriginal peoples, other ethnic groups, and women. They are encouraged to consider these traditions as aesthetic expressions and within broad contexts of race and gender and of social, political, and economic history.

## Qualifying-Year Program

Applicants who do not qualify for direct admission to the master's program may be admitted to a qualifying-year program. Applicants who lack an Honours degree, but have a 3-year degree with an honours standing (at least B overall) will normally be admitted to a qualifying-year program. Refer to the general Regulations section of this Calendar (see p. 50).

## Master of Arts

### Admission Requirements

The minimum requirement for admission to the master's program is an Honours bachelor's degree (or the equivalent) in art history or a related discipline, with at least high honours standing. Related disciplines may include anthropology, Canadian history, and Canadian studies. Applicants without a background in art history may be required to take up to a maximum of 2.0 credits in certain designated courses from the undergraduate art history program in addition to their regular program.

### Program Requirements

The specific program requirements for students in the M.A. program are as follows:

- \* Art History 11.500 (1.0 credit)
- \* 2.0 credits with a minimum of 1.0 and no

more than 1.5 to be taken from the following six areas of concentration in Canadian art: Euro-American tradition, Indian art, Inuit art, architecture, photography, folk and popular arts

- \* Art History 11.599 (2.0 credits)

Subject to the approval of the graduate supervisor, 0.5 credit may be taken outside the Art History program. A maximum of 1.0 credit may be selected from course offerings at the 400-level in Art History.

The student's program will be developed in consultation with the graduate supervisor and graduate faculty of Art History, and must be approved by the graduate supervisor. The prescribed program will take into account the student's background and special interests, as well as the research strengths of the Art History graduate faculty.

## Deadlines

### Thesis Proposal

Full-time students will normally submit their thesis topic to the thesis proposal board no later than April 15 of the first year of registration for students enrolled full-time, and no later than the middle of the fifth term of registration for students enrolled part-time.

### Thesis

Regulations governing requirements for the master's thesis, including deadlines for submission, are outlined in the General Regulations (see p. 60.)

## Language Requirements

Students are required to demonstrate a reading knowledge of French (or another language to be approved by the Art History graduate supervisor).

## Academic Standing

A standing of B- or better must be obtained in each credit counted towards the master's degree.

## Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

FW,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

## Art History

Art History 11.500T2

### **The Practice of Canadian Art History**

This course examines three areas: (1) the historiography of both native and non-native Canadian art history; (2) the history and practice of collecting institutions in the six areas of concentration in Canadian art: Indian art, Inuit art, Canadian art, Euro-American tradition, architecture, folk and popular arts, and photography with attention to questions posed by new methodologies and theoretical approaches; and (3) cross-cultural and multi-cultural aspects of contemporary art. Additionally, the course provides on-site introduction to techniques of archival and collection research within the major collecting institutions in Ottawa.

Art History 11.501F1, W1 or S1

### **Graduate Practicum**

This course involves practical on-site work in Ottawa collecting institutions (as available) and an extensive written assignment derived from the practicum project. The departmental graduate practicum coordinator and the on-site supervisor are jointly responsible for the final mark. A maximum of one 1.0 credit practicum will be accepted towards degree requirements.

Art History 11.502F1, W1, S1

### **Directed Readings and Research**

Tutorials designed to permit students to pursue topics in Canadian art which they have selected in consultation with the faculty of the program.

Art History 11.511F1 or W1

### **Topics in Historical Canadian Art**

This course will consider the social, political, economic and aesthetic contexts for art produced in Canada in selected periods from the French settlement to 1900. Emphasis will be placed on the adoption and transformation of European traditions by artists and sculptors in New France, British North America, and post-Confederation Canada in order to define the nature of the Canadian artistic ethos. Consideration will also be given to the impact of Canada's geographical proximity to the United States, and the Canadian response to ideas emanating from that source.

Art History 11.512F1 or W1

### **The History of Art Criticism in Canada to 1940**

Critical reaction to art exhibition held by organizations such as the Ontario Society of Artists, the Art Association of Montreal, and the Royal Canadian Academy, among others, will be examined in order to establish the climate of public opinion, the pattern of critical methodology, and the assumptions implicit in contemporary aesthetic ideas at various pe-

riods in the development of Canadian art. Preferences for certain types of subject matter, stylistic approaches, compositional formats, and scale will also be considered, as will the effect of criticism upon the artists' work.

Art History 11.513F1 or W1

### **Esotericism in Canadian Art**

This course examines the influence of such factors as Theosophy, mysticism, Buddhism and alchemy on selected twentieth-century artists and their work. It also addresses the theoretical and methodological problems raised by such influences.

Art History 11.514F1 or W1

### **Canadian Women Artists: Between the World Wars**

An examination of art by women in light of the role played by painters, sculptors, printmakers and photographers in the formation of artists' groups, in the development of modernist art and in the production of commissioned works of art which served as Canadian civic and/or national symbols.

Art History 11.515F1 or W1

### **Reading Modernism and Post-Modernism in Canada**

This course will examine writings on Canadian modernist and post-modernist art by artists and critics in light of current concerns about audience response and reception theory.

Art History 11.516F1 or W1

### **Contemporary Women Artists - 1970 to the Present: Vision and Difference**

This course will consider the art of contemporary women artists in the context of cultural, social/political and feminist issues. Examination of patronage systems, viewer response and contemporary art theory will provide additional foci for the discussion of gender and contemporary art-making.

Art History 11.517F1 or W1

### **Public Art in Canada: Issues and Realities**

This course will examine works of art commissioned for public spaces. Emphasis will be placed on analysis of the art and the interrelationships among the artist, the patron, the critic and the public. Consideration of the social, cultural and political contexts and resultant issues will also be addressed.

Art History 11.518F1 or W1

### **Contemporary Canadian Earthworks and Environmental Art**

This course examines selected Canadian artists who create art in nature, and/or with the elements of earth, air, fire and water. These artists are considered from the perspectives of international environmental art, the Canadian landscape tradition, and current ecological concerns.



Art History 11.519W1

**Aspects of Contemporary Art Practice**

This course offers opportunities to examine a wide spectrum of contemporary art practice in Canada. Explorations of the artist collective, traditional and new media (painting, sculpture, installation, video, computer art, etc.), relationship of artist and society, critical and public reception of contemporary art production, as well as interaction between institutional collecting and artist-run centres will provide the basis for a cultural analysis of specific sites of individual and institutional practice.

Art History 11.520F1 or W1

**Art of the Woodlands Indians in the Historic Period**

This course will examine traditions of art-making in eastern Canada from the beginning of European contact through the early twentieth century. It will consider three major cultural groupings: the Eastern Sub-Arctic, the Iroquoian peoples, and the Algonkian peoples.

Art History 11.521F1 or W1

**Art of the Plains Indians in the Historic Period**

This course examines and seeks to define the distinctive artistic expressions of a regional culture - the Canadian Plains Indians - in the historic period. Reference will be made to traditional art forms, symbolism, and the adjustments made by native artisans to the changing socio-economic context in the historic period.

Art History 11.522F1 or W1

**Art of the North-West Coast Indians in the Historic Period**

The focus for the course will be the art of the North-West Coast Indians of Canada from contact through the early twentieth century. Art will be studied in its context of ritual and use, and also as an expression of changing relations with the European colonial presence (stylistic change and the growth of 'tourist art.') Stress will be placed on art as a changing symbolic system generated by historical, social, and environmental experience.

Art History 11.523F1 or W1

**Museums and First Nations in Canada**

This course will study the representation of aboriginal culture in Canadian museums through the historical examination of institutions, exhibitions and collecting and research policies. Particular emphasis will be placed on changing treatments of objects as 'art' and as 'artifact.'

Art History 11.524F1 or W1

**Contemporary Indian Art**

This course will study selected aspects of contemporary aboriginal art in Canada, focusing on the period since 1960. Current debates about museum representation, appropriation, and marginalization will also be discussed.

Art History 11.526F1 or W1

**Canadian Art and the Museum**

This course will examine the ways that visual arts produced by the peoples of Canada have been represented in museums and art galleries. The two broad areas to be addressed will be the theory of museum representation and the historical development of the museum in the West, with a special focus on the histories of Canadian institutions and their landmark exhibitions.

Art History 11.527F1 or W1

**Creating an Exhibition**

Students in this course will curate an exhibition of works of art from Canada for display in a museum or gallery in the Ottawa region. Guided by museum professionals, they will study the main aspects of professional curatorial practice through hands-on experience in developing the exhibition concept, selecting and researching the works, writing the exhibition texts and designing the installation.

Art History 11.528F1 or W1

**Museum Studies and Curatorial Practice: Theory and Practice**

A seminar realizing an exhibition of Canadian art to be presented at the Carleton University Art Gallery. This will involve conceptualization, research, selection, cataloguing, labeling, promotion, contextualization, and evaluation using the collections of the Gallery.

Art History 11.530F1 or W1

**Prehistoric and Historic Inuit Art**

This course addresses cultural production by the people of the North American Arctic during prehistoric and historic periods. The perspectives of art history will be compared with those of anthropology in considering such matters as fusion of aesthetic and utilitarian requirements in objects of use, artistic continuity and change, and the diffusion of style through time and across geographic area.

Art History 11.531F1 or W1

**Contemporary Inuit Sculpture**

The development of contemporary Inuit sculpture from 1949 to the present will be addressed in this course. Consideration will be given to the evolution of regional and individual styles and to the effect of government policies and market forces on this work.



## Art History

Such matters as acculturation, identity, and cultural affirmation will be considered.

Art History 11.532F1 or W1

### **Contemporary Inuit Graphic Arts**

This course will examine the development of contemporary Inuit graphic arts from 1957 to the present. Prints, drawings, and other two-dimensional media will be considered with attention given to the development of regional and individual styles and to the effect of government policies and market forces on the work. Such matters as acculturation, identity, and cultural affirmation will be considered.

Art History 11.533F1 or W1

### **Topics in Contemporary Inuit Art**

Selected topics relating to the historical development and significance of Canadian Inuit art in the broad context of world art will be addressed in this seminar. Topics may include such broad themes as historiography, cross-cultural aesthetics, and the relationship of contemporary Inuit art to contemporary critical and social theory.

Art History 11.540F1 or W1

### **Aspects of Historical Architecture in Canada**

This course will consider selected aspects of historical architecture in Canada from the French settlement to Confederation. Particular emphasis will be placed on the traditional architecture of Quebec, the role of British-trained architects in the post-1760 period, the impact of institutional and private patrons in shaping the pattern of development, the emergence of distinctive Canadian forms, and the recognition of architects as a professional group distinct from that of builders.

Art History 11.541F1 or W1

### **Canadian Architecture 1867-1940: Themes and Approaches**

This course will examine the traditional interpretations of Canadian architecture in light of current research methodologies and recent advances in historical writing. Emphasis will be placed on architecture from the Parliament Buildings in Ottawa to the advent of the Modern Movement.

Art History 11.542F1 or W1

### **Architectural Drawings in Canadian Collections**

This course will introduce students to major collections in Canada and to problems posed and insights gained through study of original perspectives, elevations, plans and working drawings.

Art History 11.543F1 or W1

### **Contemporary Canadian Architecture**

An examination of the leading figures and trends in Canadian architecture since 1950.

This includes the influence of international modernism, regionalism, urban theory, and postmodernism.

Art History 11.550F1 or W1

### **Historical Canadian Photography**

This course will examine the emergence of photography in Canada in the nineteenth and early twentieth centuries. Photographs will be examined from the perspective of their format and aesthetic qualities as well as in social, political and cultural contexts.

Art History 11.551F1 or W1

### **Modern Canadian Photography**

This course will examine the developments in pictorial, documentary and fine-art photography by amateur and professional photographers in Canada from 1900 to 1945.

Art History 11.560F1 or W1

### **Canadian Folk and Popular Arts: Sources and Styles**

This course will examine regional and community-based artistic traditions, particularly those involving immigrants to Canada from Europe and other parts of the world. It will survey sources and styles with particular emphasis on the social context of artistic practice and appreciation.

Art History 11.561F1 or W1

### **Canadian Folk and Popular Arts: Critical Readings**

This course will examine the development of discourse on folk and popular arts in North America with special reference to Canada. The relationship between theoretical approaches taken in the literature and the practice of research as evidenced in exhibition production and collection building will be addressed. Nationalism, regionalism and the influence of the market are among those topics identified for particular emphasis.

Art History 11.599F4, W4, S4

### **M.A. Thesis**

# Ottawa-Carleton Institute of Biology

2240 Herzberg Building  
Telephone: 520-2600, ext. 8769  
Fax: 520-2569

Université d'Ottawa  
University of Ottawa



Carleton University

## The Institute

Director of the Institute, S. Perry

Associate Director, P. Vierula

Students pursuing studies in biological sciences at the M.Sc. and Ph.D. levels in the Ottawa area do so in a co-operative program that combines the resources of the Departments of Biology of Carleton University and the University of Ottawa. The two universities have a joint committee supervising the programs, regulations, and student admissions.

Students are admitted for graduate work under the general regulations of the Institute. Additional criteria for admission include academic performance, research experience, and referees' appraisals. The student must also be accepted by a faculty member who will supervise the research project, and the choice of supervisor will determine the primary campus location of the student. The student's advisory committee will normally include faculty members from both universities.

Requests for information, and completed applications should be sent to the Director or Associate Director of the Institute. Additional information may also be obtained through the Institute website, at <http://www.carleton.ca/~jhelava/biology/biology.html>

## Members of the Institute

- \*J.B. Armstrong, *Developmental Biology*
- \*J.T. Amason, *Biochemical Ecology*
- \*B.F. Benkel, *Animal Molecular Biology*
- \*Linda Bonen, *Molecular Biology*
- \*Stephen J. Brooks, *Animal Biochemistry*
- \*D.L. Brown, *Cell Biology*
- \*M.J. Canny, *Whole Plant Physiology*
- \*N. Cappuccino, *Population and Community Ecology*
- \*G.R. Carmody, *Population Genetics*
- \*P.M. Catling, *Plant Biosystematics*
- \*N. Chaly, *Cell Biology*
- \*François Chapleau, *Fish Evolution*

- \*Christiane Charest, *Plant Physiology*
- \*Robert Charlebois, *Microbiology*
- \*J.J. Cheetham, *Membrane Biochemistry*
- \*D.J. Currie, *Community Ecology, Biogeography*
- \*Hans Damman, *Insect Behavioural Ecology*
- \*J.R. Dillon, *Molecular Genetics*
- \*Guy Drouin, *Molecular Genetics*
- \*Lenore Fahrig, *Population Ecology and Ecological Modelling*
- \*J.M. Farber, *Food Microbiology*
- \*J.C. Fenwick, *Comparative Endocrinology*
- \*C.S. Findlay, *Evolution*
- \*Mark Forbes, *Evolutionary Ecology*
- \*Kathryn Freemark, *Ecology, Behaviour and Systematics*
- \*David R. Gardner, *Neuroscience*
- \*A.J. Gaston, *Conservation Biology*
- \*K.M. Gilmour, *Comparative Respiratory Physiology*
- \*W.D. Gould, *Biotechnology*
- \*D.A. Hickey, *Population Genetics*
- \*J.G. Houseman, *Insect Physiology*
- \*Byron Johnson, *Cell Biochemistry*
- \*D.A. Johnson, *Molecular Biology*
- \*P.A. Keddy, *Plant Ecology*
- \*Sean W. Kennedy, *Environmental Toxicology*
- \*Iain Lambert, *Molecular Biology and Genetic Toxicology*
- \*L.R. Lefkovitch, *Mathematical Biology*
- \*M.E. McCully, *Plant Ultrastructure and Development*
- \*B.L.A. Miki, *Plant Molecular Biology*
- \*Pierre Mineau, *Ecology, Behaviour and Systematics*
- \*R.E.J. Mitchel, *Radiobiology*
- \*T.W. Moon, *Comparative Physiology*
- \*Antoine Morin, *Freshwater Ecology*
- \*Catherine Morris, *Physiology of Excitable Cells*
- \*Micheline Paulin-Levasseur, *Cell Biology*
- \*S.B. Peck, *Arthropod and Beetle Evolution Systematics*
- \*S.F. Perry, *Comparative Respiratory Physiology*
- \*Bernard Philogène, *Ecophysiology of Insects*

- \* Frances Pick, *Microbial Physiology and Ecology*
- \* Jaroslav Picman, *Behavioural Ecology*
- \* V.L. Seligy, *Molecular Genetics*
- \* John Sinclair, *Biophysics of Cells*
- \* Myron Smith, *Fungal Molecular Genetics*
- \* K.B. Storey, *Biochemical Adaptations*
- \* Vance Trudeau, *Comparative Endocrinology*
- \* J.P. Vierula, *Molecular Biology*
- \* P.R. Walker, *Molecular Mechanisms of Apoptosis*
- \* P.J. Weatherhead, *Behavioural Ecology*
- \* Jean-Michel Weber, *Metabolic Physiology*
- \* D.M. Wood, *Insect Systematics*
- \* R.C. Wyndham, *Microbial Genetics and Ecology*
- \* Hiroshi Yamazaki, *Bacterial Metabolism, Biotechnology*

### **Ottawa-Carleton Specialization in Neuroscience**

The Departments of Biology and Psychology at Carleton University, and the Departments of Anatomy, Physiology, and Psychology at the University of Ottawa provide a graduate specialization in neuroscience at the M.Sc. and Ph.D. level. For further details see p. 261.

### **Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology**

The Departments of Biology and Chemistry at Carleton University and at the University of Ottawa provide a collaborative program in chemical and environmental toxicology at the M.Sc. level. For further details see p. 110.

Each campus is well equipped for a wide range of biological research. Some major equipment and facilities include scanning and transmission electron microscopes; confocal laser scanning microscope; digital light microscope and image analysis facilities; conventional and digital darkrooms; animal and plant growth facilities; animal cell culture facilities; electro-physiology equipment; computer systems for genomic studies, modelling of ecological systems, and access to the Internet and the Web; DNA and protein analysis facilities, including electrophoresis and chromatographic equipment, and ultracentrifuges. Students also benefit from the resources of nearby government laboratories and libraries, including Agriculture Canada, Environment Canada, Health and Welfare Canada, and the National Research Council.

## **Master of Science**

### **Admission Requirements**

An Honours B.Sc. or equivalent degree at a standard acceptable to the two universities is required for admission to the M.Sc. program. Applicants with acceptable standing in a non-honours degree may be admitted to a qualifying-year program which will be determined in each case by the admissions committee.

Applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

### **Program Requirements**

The M.Sc. degree will be conferred upon a candidate who has fulfilled the following requirements:

- \* Completion of the advanced courses specified by the admissions committee and the student's advisory committee; these will range from one to three full (two-term) courses, depending on the background and research program of the student. At least one course at the graduate level must be included, and not more than one course at the Fourth-year honours level (completed while registered as a graduate student) may form part of the candidate's course requirements. The passing grade for all required courses is 70% or the equivalent, and the student is not allowed a supplemental examination. Directed studies or reading courses may not make up more than half of the required number of courses. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement.

- \* Completion of at least two terms as a full-time student resident at one of the two universities is normally required. Programs for part-time students may be arranged.

- \* Presentation of one public seminar on the candidate's thesis research

- \* Completion of a thesis incorporating the results of original research carried out under the direct supervision of an approved faculty member

- \* Successful oral defence of the thesis before an examination board of at least three faculty members, normally drawn from both universities



## Guidelines for Completion of Master's Degree

The maximum time limits for the completion of the requirements of the master's program are listed in this Calendar in the General Regulations, Section 13 (see p. 63.) Full-time candidates in the master's program are expected to complete their degree requirements within six terms of first registration for full-time study. Part-time candidates in the master's program, and candidates who elect to complete their program by a combination of full-time and part-time study, are expected to complete their degree requirements within four calendar years or twelve terms from the initial registration in the master's program.

## Doctor of Philosophy

### Admission Requirements

An M.Sc. from a recognized university is usually required for entry to the Ph.D. program; however, an applicant with a first class B.Sc. and excellent references may be admitted directly to the Ph.D. program. A student already registered for the M.Sc. may be permitted to transfer to the Ph.D. program following a recommendation by the departmental graduate committee and successful completion of the comprehensive examination required of Ph.D. candidates.

All applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

### Program Requirements

The Ph.D. degree will be conferred upon a candidate who has fulfilled the following requirements:

- \* Completion of the courses at the graduate level specified by the admissions and advisory committees; these will range from one to four full courses (two to six courses if admitted without an M.Sc.), depending on the background and research program of the student. Only graduate courses may form part of the candidate's course requirements. The passing grade for all required courses is 70%, and the student is not allowed a supplemental examination. Directed studies or reading courses may not make up more than half of the required number of courses. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement.

- \* Completion of an oral comprehensive examination within approximately twelve months of entry into the program; this examination will cover the candidate's area of research, and general biology. The format of the examination will be established by the departmental graduate committee and approved by the admissions committee. The examination committee will generally be composed of faculty members of both universities.

- \* Presentation of at least one public seminar on the candidate's thesis research.

- \* A thesis incorporating the results of original research carried out under the direct supervision of an approved faculty member

- \* Completion of at least four terms as a full-time student resident at one of the two universities (or six terms if admitted without an M.Sc.) is normally required. Under exceptional conditions programs may be arranged for part-time students.

- \* Successful oral defence of the thesis before an examination board of at least five faculty members, with representation from both universities, and including an external examiner from outside the two universities who is an authority on the thesis research area.

## Guidelines for Completion of the Doctoral Degree

The maximum time limits for the completion of the program requirements of the doctoral program are listed in the General Regulations, Section 13. Full-time candidates in the doctoral program are expected to complete their oral comprehensive examination within approximately twelve months of entry into the program. Part-time candidates in the doctoral program are expected to complete their oral comprehensive examination within approximately eighteen months of entry into the program. Full-time candidates are expected to complete their degree requirements within four calendar years or twelve terms of registered full-time study. Doctoral candidates who have transferred from the master's to the doctoral program without completing the master's program are expected to complete their degree requirements within four calendar years or twelve terms of registered full-time study from initial registration in the master's program. Part-time candidates in the doctoral program, and candidates who elect to complete their program by a combination of full- and part-time study, are expected to complete their degree requirements within six calendar years or eighteen terms after the date of initial registration.



## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Biology 61.501F1 (BIO5101)

### Topics in Biotechnology

A course concerned with the utilization of biological substances and activities of cells, genes, and enzymes in manufacturing, agricultural, and service industries. A different topic will be selected each year.

Prerequisite: A course in cell physiology or biochemistry, or permission of instructor.

Biology 61.503F1 (BIO5103)

### Comparative Biochemistry

Advanced topics emphasizing biochemical structures, functions, and methodologies in the context of animal (invertebrates and vertebrates) adaptations to environmental stress. The course will be offered in alternate years.

Prerequisite: An undergraduate biochemistry course.

Biology 61.509F1, W1 (BIO8124)

### Ontario Vegetation: Patterns, Processes and Protection

Patterns of vegetation and plant species distributions in Ontario will be investigated with respect to their origin and maintaining processes. Current methods of protection of significant and representative vegetation using zonal concepts will be considered.

Biology 61.510W1 (BIO5301)

### Plant Development

An advanced course dealing with selected topics in the experimental study of plant development.

Biology 61.515F1 (BIO5302)

### Methods in Molecular Genetics

The purpose of this course is to review the fundamental theory and techniques in genetic manipulation of prokaryotes and eukaryotes and to examine some of the innovative new strategies being applied to a variety of problems in molecular biology.

Precludes additional credit for Biology 61.416★ or 61.517.

Prerequisite: Graduate standing and permission of the Department.

Biology 61.516W1 (BIO5308)

### Laboratory Techniques in Molecular Genetics

This laboratory course, which is complementary to Biology 61.517, is designed to give students practical experience in many of the important techniques in molecular genetics. Precludes additional credit for Biology 61.419★ or 61.517.

Prerequisite: Graduate standing and permission of the Department.

Biology 61.521F1 (BIO8301)

### Evolutionary Genetics and Computer Analyses

Students will learn the basic concepts in molecular evolution and gain hands-on experience with the computer analysis of DNA sequences. Topics covered will include molecular sequence databases, multiple alignments, amino acid and codon usage, molecular clocks, and phylogenetic trees.

Prerequisites: Graduate standing plus basic courses in genetics and evolution; permission of the Department.

Biology 61.522W1 (BIO8302)

### Topics in Evolutionary Genetics

A lecture/seminar course on the genetic mechanisms and forces responsible for variation and evolutionary change in natural populations. Topics to include protein and genome evolution, molecular phylogenies, DNA sequences in population biology, and the evolution of multigene families.

Prerequisites: Graduate standing plus basic courses in genetics and evolution; permission of the Department (Alternate years)

Biology 61.523F1 (BIO8303)

### Techniques of Light Microscopy

An advanced laboratory and lecture course on the principles and techniques of light microscopy.

Precludes additional credit for Biology 61.520 (BIO8238) (if taken before 1997-98).

Prerequisite: Open to Fourth-year and graduate students with consent of the instructor.

Biology 61.524W1 (BIO8304)

### Techniques of Electron Microscopy

An advanced laboratory and lecture course on the principles and techniques of electron microscopy.

Precludes additional credit for Biology 61.520 (BIO8238) (if taken before 1997-98).

Prerequisite: Open to Fourth-year and graduate students with permission of the instructor.

Biology 61.525T2 (BIO5204)

### Plant Physiology and Metabolism

An advanced course dealing with selected topics in plant physiology and plant metabolism. Prerequisite: Graduate standing or permission of the Department.

**Biology 61.534T2 (PSY6201)**

**Basics of Neuroscience**

A comprehensive neuroscience course from the membrane and the cellular levels through to the behavioural aspects of invertebrates and vertebrates. Lectures and tutorials cover such aspects of neuroscience as neuroanatomy, neurophysiology, behavioural neuroscience and neuropharmacology. (Also listed as Psychology 49.520)

**Biology 61.536F1, W1 (BIO9201)**

**Photobiology**

A course dealing with the interaction between light and living organisms, including an introduction to photochemistry, and a detailed study of photosynthesis, vision, photosensitivity, and photoperiodism.

**Prerequisite:** An advanced course in animal or plant physiology or biochemistry, or permission of the Department.

**Biology 61.537F1 (BIO8122)**

**Advanced Insect Physiology**

Physiological characteristics of insects.

**Biology 61.542T2 (BIO8162)**

**Developmental Endocrinology / Topics in Comparative Endocrinology**

A lecture and reading course concerned with classical as well as current topics in the field of comparative endocrinology. Special emphasis is placed on the vertebrates. Offered in alternate years.

**Prerequisite:** An undergraduate course in endocrinology.

**Biology 61.545T2 (BIO9202)**

**Project in Applied Ecology**

A course in the form of a special research project in which the student identifies an environmental problem and the corporate or governmental body that has the power to rectify the problem. (Enrollment is limited).

**Biology 61.546F1 (BIO9303)**

**Advanced Plant Ecology**

Plant population biology, and its usefulness in explaining attributes of plant communities is discussed. During the labs, projects will be carried out to clarify topics such as vegetation classification and competition.

**Biology 61.547W1 (BIO5305)**

**Quantitative Ecology**

A course on analysis of the distribution and abundance of organisms, and of related environmental phenomena.

**Prerequisites:** Graduate standing, courses in elementary ecology, elementary statistics and biostatistics, and permission of the Department.

**Biology 61.549F1, W1 (BIO5306)**

**Mathematical Modelling for Biologists**

This course is designed to develop mathematical tools for the modelling of biological processes. The student is taught the necessary mathematics and a computer language, and guidance is given in the choice of simulation of a biological process.

**Biology 61.550T2 (BIO5207)**

**Selected Topics**

Courses in selected aspects of specialized biological subjects not covered by other graduate courses; course details will be available at registration.

**Biology 61.551F1 (BIO8104)**

**Selected Topics in Biology I**

Courses in selected aspects of specialized biological subjects not covered by other graduate courses; course details will be available at registration.

**Biology 61.552W1, S1 (BIO8102)**

**Selected Topics in Biology II**

Courses in selected aspects of specialized biological subjects not covered by other graduate courses; course details will be available at registration.

**Biology 61.553T1 (BIO5901)**

**Recent Advances in Biology**

A course intended for all first-year graduate students to bring them up to date in the various major areas of biology. The course consists of selected readings, lectures, and invited speakers. The course is graded Satisfactory/Unsatisfactory.

**Biology 61.556F1, W1 (BIO5213)**

**Advanced Insect/Animal Systematics**

A lecture and seminar course concerning methods, roles and advances in systematics of insects and other animals. One research project required.

**Prerequisite:** A 400-level course in identification or classification of insects or other animals.

**Biology 61.558F1 (BIO8306)**

**Advanced Topics in Ecology I**

Lectures, seminars and discussions on current literature on experimental approaches, concepts, and findings in population and community ecology, ecosystem and landscape ecology, and biostatistics. The content complements 61.559(BIO8307).

Precludes additional credit for Biology 61.548 (BIO9200) (if taken before 1997-98).

**Biology 61.559W1 (BIO8307)**

**Advanced Topics in Ecology II**

Lectures, seminars and discussions on current literature on experimental approaches, concepts and findings in population and com-

munity ecology, ecosystem and landscape ecology and biostatistics. The content complements 61.558(BIO8306).

Precludes additional credit for Biology 61.548 (BIO9200) (if taken before 1997-98).

Biology 61.560T2 (BIO5160)

**Advanced Topics in Insect Evolution**

An exploration of major concepts and questions in insect evolution in the areas of systematics, morphology, the fossil record, biology, and behaviour.

Biology 61.565F1, W1, S1 (BIO5102)

**Field Course**

Credit for this 0.5 credit course is based on a total of three weeks of field-course modules, involving one or two weeks of intensive and continuous field work with attendant assignments. For details, see coordinator.

Biology 61.579 (BIO 8113)

**Chemical Toxicology**

An introduction to modeling chemical hazards and exposures at the cellular level. The properties of toxic substances are compared to the responses of enzymatic systems. These interactions are defined as Quantitative Structure-Activity Relationships and used to interpret hazardous materials under regulations such as WHMIS. (Also listed as Chemistry 65.579(CHM8157))

Prerequisite: Biology 61.642/Chemistry 65.578(BIO 9101/CHM 8156).

Biology 61.581F1 (BIO5105)

**Animal Behaviour**

A 0.5 credit course in animal behaviour from an ecological and evolutionary point of view, with additional independent assignments.

Prerequisites: Biology 61.335« and 61.361« or equivalents and registration in a graduate program, or written permission of the Department.

Biology 61.582F1 or W1 (BIO8365)

**Advanced Behavioural Ecology I**

Recent ideas and research on advanced topics dealing with the evolution of foraging, temporal, spatial, and reproductive strategies are discussed and critically examined. Offered in alternate years.

Biology 61.599F, W, S

**M.Sc. Thesis**

Biology 61.601F1 (BIO8109)

**Advanced Molecular Biology I**

Recent advances in molecular biology. Topics for discussion may include the following: DNA structure and function, the organization of the genome; DNA, RNA and protein synthesis; the regulation of gene expression in eucaryotes and procaryotes. Topics reflect the interests of the teaching staff. Biology

61.602(BIO8116) and this course are normally not offered together in the same year but only in alternate years. Not all topics will be covered each year.

Biology 61.602W1 (BIO8116)

**Advanced Molecular Biology II**

Recent advances in molecular biology. Topics for discussion may include the following: metagenesis and DNA repair mechanism; molecular aspects of gene transfer recombination and gene arrangement; gene transfer mechanisms, the molecular biology of yeasts and fungi, especially with regard to industrial applications; the modern techniques of genetic engineering as applied to industrial and medical problems. Topics reflect the interests of the teaching staff. Biology 61.601(BIO8109) and this course are normally not offered together in the same year but only in alternate years. Not all topics will be covered each year.

Biology 61.621F1 (BIO8117)

**Advanced Cell Biology I**

Recent advances in cell biology. Topics for discussion may include the following: the composition, biosynthesis and three-dimensional organization of the cytoskeleton, factors regulating its deployment and the role of cytoskeletal elements in mitosis, cell-substrate attachment, cell motility, transport of organelles and axoplasmic transport, cell surface and extracellular matrix. Topics reflect the interests of the teaching staff. Biology 61.622(BIO8118) and this course normally will not be offered together in the same year but only in alternate years. Not all topics will be covered each year.

Biology 61.622W1 (BIO8118)

**Advanced Cell Biology II**

Topics for discussion may include the following: the structure, composition and three-dimensional organization of the nucleus, mechanisms and regulation of genome replication, structure organization of transcription. Role of the nucleus in virus replication and hormone response, structural and functional reorganization of nuclear components during gamete development, fertilization and the mitotic cell cycle. Topics reflect the interests of the teaching staff. Biology 61.621(BIO8117) and this course are normally not offered together in the same year but only in alternate years. Not all topics will be covered each year.

Biology 61.623F1(ANA7400)

**Neuroscience Techniques I**

Completion of a research project carried out under the supervision of a neuroscience faculty member. Students may carry out their project in any department participating in the neuroscience specialization provided they



have approval from the administrative head of their particular program. For example, students in the neuroscience specialization must obtain approval from the neuroscience committee. Students in the biopsychology concentration must obtain approval from the Department of Psychology. Credit is granted for learning new research techniques. (Also listed as Psychology 49.624)

Biology 61.624W1 (ANA7400)

### **Neuroscience Techniques II**

Completion of a research project carried out under the supervision of a neuroscience faculty member. Students may carry out their project in any department participating in the neuroscience specialization provided they have approval from the administrative head of their particular program. For example, students in the neuroscience specialization must obtain approval from the neuroscience committee. Students in the biopsychology concentration must obtain approval from the Department of Psychology. Credit is granted for learning new research techniques. (Also listed as Psychology 49.625)

Biology 61.625F1 or W1 (BIO8319)

### **Advanced Plant Physiology**

A lecture and seminar course dealing with selected topics in advanced plant physiology, available only to graduate students. Prerequisite: Biology 61.429 or equivalent, or permission of the Department.

Biology 61.627F1 (BIO8164)

### **Ion Channels**

A lecture and seminar course on the physiological and biophysical characteristics of ion channels. Topics are selected from such areas as: determinants of channel selectivity, conformation changes, chemically-induced and voltage-induced gating, models of excitability, methods of studying channels (single channel studies, gating currents, pharmacological tools), and cellular distribution, modulation and development of channels. Offered in alternate years.

Biology 61.630F1 or W1 (BIO8320)

### **Advanced Plant Biochemistry**

A lecture and seminar course, available only to graduate students, dealing with selected topics in advanced plant biochemistry. Prerequisites: Biology 61.425★ and Biology 61.426★/427★, or permission of the Department.

Biology 61.633T2

### **Advanced Seminar in Neuroscience**

A comprehensive proseminar covering specialized topics in neuroscience and biopsychology. The presentations focus on the active research areas and interests of faculty

members and will provide an in-depth coverage of research strategies, methods and results. Graduate student presentations of current research projects are an integral part of the course. (Also listed as Psychology 49.620). Prerequisite: Psychology 49.520.

Biology 61.634F1 (BIO8361)

### **Advanced Topics in Animal Physiology**

In-depth study of areas in animal physiology of current research interest.

Biology 61.641F1 (BIO8935)

### **Recent Advances in Plant Biology**

Special topics of current interest.

Biology 61.642 (BIO 9101)

### **Principles of Toxicology**

This course identifies the basic theorems of toxicology with examples of current research problems. Toxic risk is defined as the product of intensive hazard and extensive exposure. Each factor is assessed in scientific and social contexts and illustrated with many types of experimental material. (Also listed as Chemistry 65.578 (CHM 8156))

Biology 61.643

### **Ecotoxicology**

Concepts of ecotoxicology, emphasizing whole ecosystem response to hazardous contaminants. The focus is the impacts of chronic and acute exposure of ecosystems to toxicants, the methods of pesticide, herbicide and pollutant residue analysis and the concept of bound residues. (Also listed as Chemistry 65.575 (CHM 9109))

Prerequisite: Biology 61.642/Chemistry 65.578 (BIO 9101/CHM 8156).

Biology 61.644F1 (BIO8436)

### **Plant: Animal Interactions**

Secondary metabolites of plants and their role as attractants or antifeedants to animals and as allelopathic or antifungal agents. Emphasis is placed on co-evolution of plants and phytophagous organisms such as insects and mammals, and the ecological and physiological dimensions of this relationship. Offered in alternate years.

Biology 61.645 (BIO 9105)

### **Seminar in Toxicology**

This course introduces the seminar format and involves student, faculty and invited seminar speakers. The student will present a seminar and submit a report on a current topic in toxicology. (Also listed as Chemistry 65.585 CHM 8167))

Biology 61.655W1 (BIO8108)

### **Advanced Topics in Development**

Recent advances in developmental biology. Topics may include embryonic induction, regulation of morphogenesis and differentia-



tion, mechanisms of regional specification and pattern formation, and developmental genetics. Offered in alternate years.

Biology 61.680F1 or W1 (BIO8103)

**Advanced Behavioural Ecology II**

A seminar and laboratory course dealing with current topics in the study of animal behaviour.

Prerequisites: Biology 61.581 or equivalent, or permission of the Department.

Biology 61.699F, W, S

**Ph.D. Thesis**

## Ottawa-Carleton Collaborative Program in Biostatistics

Herzberg Physics 4314  
Telephone: 520-2152  
Fax: 520-3536  
E-mail: brichter@math.carleton.ca

### The Specialization

Coordinator, Mathematics and Statistics (Carleton University), C.W.L. Garner

Coordinator, Mathematics and Statistics (University of Ottawa), D.R. McDonald

Coordinator, Epidemiology (University of Ottawa), Sankaranarayanan Raman

Biostatistics is an interdisciplinary area of research linking statistics, biology and medicine. This growing area demands knowledge of the theory behind statistical procedures, an ability to put that theory into practice, and an understanding of the areas of application. The applications range from clinical trials to population epidemiology and the development of new procedures.

The Specialization in Biostatistics is intended to prepare a student for a career as a biostatistician in health-related industry, or for a doctoral program in biostatistics. This program takes advantage of several resources particular to the Ottawa area. The Ottawa-Carleton Institute of Mathematics and Statistics offers a strong program in statistics. The Department of Epidemiology and Community Medicine at the University of Ottawa offers a broad range of courses in epidemiology. In addition, there are several research institutes and teaching hospitals in the Ottawa area. These resources provide students with opportunities to develop analytic skills, to interact with practitioners and to work on current research projects in a variety of areas.

The program is administered by a committee of representatives from the primary departments which include: the Department of Epidemiology and Community Medicine at the University of Ottawa, the School of Mathematics and Statistics at Carleton University, and the Department of Mathematics and Statistics at the University of Ottawa.

### Members of the Specialization

The home department of each member is indicated by (C) for the School of Mathematics and Statistics, Carleton University; (UO) for the Department of Mathematics and Statistics, University of Ottawa; (EPI) the Department of Epidemiology and Community Medicine, University of Ottawa.

\*Mayer Alvo, *Nonparametric Statistics, Sequential Analysis* (UO)

\*N.J. Birkett, *Dynamical Systems in Medicine* (EPI)

\*Amitava Bose, *Stochastic Modelling, Probability Theory* (C)

\*Miklós Csörgő, *Probability and Statistics* (C)

\*A.R. Dabrowski, *Invariance Principles, Weakly Dependent Variables* (UO)

\*D.A. Dawson, *Stochastic Processes and Probability Theory* (C)

\*Roger Herz-Fischler, *History and Sociology of Mathematics* (C)

\*G.B. Ivanoff, *Probability, Point Processes, Martingales* (UO)

\*Daniel Krewski, *Applied Statistics in Medicine* (C)

\*D.R. McDonald, *Applied Probability* (UO)

\*I.W. McDowell, *Health and Aging* (EPI)

\*S.E. Mills, *Applied Statistics, Statistical Methods, Inference* (C)

\*M. Mojsheibani, *Resampling, Classification and Pattern Recognition* (C)

\*R.C. Nair, *Effects of Blood and Plasma Transfusion on Certain Groups* (EPI)

\*Sankaranarayanan Raman, *Cancer Tumour Treatment, Analysis and Meta-analysis of Data from Clinical Trials* (EPI)

\*J.N.K. Rao, *Sample Surveys Theory and Methods* (C)

\*A.K.Md.E. Saleh, *Order Statistics, Mathematical Statistics* (C)

\*Iona Schiopu-Kratina, *Probability Theory, Stochastic Processes* (UO)

\*Avi Singh, *Longitudinal Time Series and Methods for their Analysis; Categorical-data Time Series* (C-Adjunct)

\*R.A. Spasoff, *Analysis of Clinical Trials* (EPI)

\*Barbara Szyszkowicz, *Statistics* (C)

\*G.A. Wells, *Clinical Trial Design and Analysis* (EPI)

### Master of Science Admission Requirements

The Specialization is open to suitable candidates enrolled in a master's program in any of the participating departments. There are two streams to the Specialization.

Students requesting admission through the Department of Epidemiology and Community Medicine will normally have an Honours B.Sc. with high honours standing (or the equivalent) in health sciences or biology, and strong analytic skills. Students admitted through the Department of Epidemiology and

Community Medicine follow a program with an emphasis on population or clinical epidemiology.

Students requesting admission through the Ottawa-Carleton Institute of Mathematics and Statistics, either through the University of Ottawa or Carleton University, will normally have an Honours B.Sc. with high honours standing (or the equivalent) in statistics and experience in the analysis of data. Students in this stream follow a program with an emphasis in clinical trial design or epidemiologic methodology.

Students should normally apply for acceptance in the Specialization in Biostatistics at the same time as they apply for admission into the master's program in Mathematics or Epidemiology. If accepted into the regular program, the student will then be considered by the program coordinators for admission into the Specialization. Students intending to apply for admission to the Specialization should normally contact prospective thesis supervisors before submitting the application and establish a thesis supervisor and research topic.

### Program Requirements

In addition to fulfilling the requirements for the master's program of the department in which they are enrolled, all students in the Specialization in Biostatistics must complete one of the two following optional program patterns:

*Master's degree by thesis:*

\* 3.5 credits

\* A compulsory 0.5 credit seminar, Mathematics 70.592(MAT5992)

\* A thesis equivalent to 1.0 credits

Students in the M.Sc. Mathematics program will normally include EPI 5240, EPI5241, EPI6178, EPI6278, MAT5190(70.560), MAT5191(70.551) and another course from the Department of Mathematics and Statistics at the graduate level.

Students in the M.Sc. Epidemiology program will normally include EPI5240, EPI5241, EPI5330, EPI6276, plus two approved courses at the graduate level in Mathematics and Statistics, among their courses.

*Master's degree by course work:*

\* 4.5 credits

\* A compulsory 0.5 credit seminar, Mathematics 70.592(MAT5992)

Students in the M.Sc. Mathematics program will normally include EPI5240, EPI5241, EPI6178, EPI6278, MAT5190(70.560), MAT5191(70.551)

and another course from the Department of Mathematics and Statistics at the graduate level. The degree awarded will in each case specify the discipline of the participating unit with Specialization in Biostatistics.

Most of the program requirements must be fulfilled in English. Students may write papers, submit theses and write examinations in both English and French.

### Thesis

The thesis may contain new research in the area of mathematics and statistics or provide a review of the literature in one area. The thesis will normally be on statistics applied to health or biology; for example, the development of a new statistical procedure, the design of a new experiment or the analysis of data. The thesis should extend beyond the routine analysis of data. The supervisor and other members examination board may be drawn from faculty members in either epidemiology or mathematics and statistics or in other related departments.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Mathematics 70.592 (MAT5992)

#### Seminar in Biostatistics

Students work in teams on the analysis of experimental data or experimental plans. The participation of experimenters in these teams is encouraged. Student teams present their results in the seminar, and prepare a brief written report on their work.

*Mathematics and Statistics*

70.560(MAT5190)

70.551(MAT5191)

70.592(MAT5992)

70.599(MAT7999)

*Epidemiology*

EPI5240 Epidemiology I

EPI5241 Epidemiology II

EPI6178 Clinical Trials

EPI6278 Advanced Clinical Trials

EPI5330 Vital and Health Statistics

EPI6276 Quantitative Methods in

Epidemiology

EPI7999 M.Sc. Thesis

## Business

Duntun Tower 710  
Telephone: 520-2388  
Fax: 520-4427

### The Department

**Director of the School,** Vinod Kumar

**Supervisor of Graduate Programs,**  
D.Roland Thomas

The School of Business offers a program of study and research leading to the degrees of Master of Management Studies and Ph.D. in Management.

### Master of Management Studies

The focus of the M.M.S. program is applied research directed toward the management of technology, productivity, and innovation. The program of study will develop in students the conceptual and methodological skills required to manage, plan, develop, and implement technological capabilities for the purpose of attaining the strategic and operational goals of organizations.

The main areas of specialization within the program are:

- \* Business Information Systems
- \* Finance
- \* International Business
- \* Management
- \* Marketing
- \* Production and Operations
- \* Research and Development Administration

Graduate students in the School of Business are governed by the General Regulations section of this Calendar. (See p. 49).

### Admission Requirements

Admission into the program is judged primarily on the applicant's ability to successfully undertake advanced studies and research in business, his/her prospects for completion of the program, experience, and achievement.

Applicants are required to have the equivalent of an Honours bachelor's degree, with a minimum of high honours standing. Applicants are expected to have credits in mathematics and the following core courses, or their equivalents, in functional areas of business described below:

- \* Business 42.211 : Introduction to Organizational Behaviour

- \* Business 42.228: Introduction to Marketing
- \* Business 42.230: Introduction to Management Science
- \* Business 42.240: Introduction to Information Systems
- \* Business 42.254: Essentials of Business Finance
- \* Economics 43.220: Statistical Methods in the Social Sciences

In addition, applicants are expected to have an upper-level course sequence in their proposed area of business specialization, and to have an adequate grounding in at least one supporting fundamental discipline such as economics, psychology, sociology, mathematics, anthropology, or computer science.

The School requires that all applicants submit scores obtained in the Graduate Management Admission Test (GMAT) offered by the Educational Testing Services of Princeton, New Jersey. A superior GMAT score will be required for admission. All applicants whose native tongue is not English must take the TOEFL test and obtain a minimum score of 550 (see p. 52).

The School's admission policy is governed by the availability of graduate student space. Possession of the minimum admission requirements does not, in itself, guarantee acceptance. Advanced standing may be granted for required courses only if previous work is judged to be equivalent to courses required in the program. Advanced standing and transfer of credit must be determined on an individual basis in consultation with the supervisor of graduate studies and must also be approved at the time of admission by the Dean of the Faculty of Graduate Studies and Research. In general, a grade of B- or better is required in equivalent courses to obtain advanced standing.

### Program Requirements

The requirement for the Master of Management Studies degree is the equivalent of 5.0 credits of which at least 4.0 credits must be at the 500-level or above. Candidates are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate advisor:

#### *Thesis Program*

- \* 3.5 credits in courses of which 1.5 credits should be from required business courses (42.592, 42.593, 42.597), 1.0 credit from a selection of advanced seminars, and 1.0 credit of approved options as indicated below
- \* a Thesis equivalent to 1.5 credits



### *Research Project Program*

\* 4.5 credits in courses of which 3.0 credits should be from a selection of advanced seminars, 1.0 credit from approved options, and either of 42.592 or 42.593 (to be approved by the School)

\* Research Project (0.5 credit).

Under exceptional circumstances, a student may, with the permission of the School, switch from the Thesis Program to the Research Project Program and vice versa upon completion of appropriate

### *Advanced Seminars*

\* Business 42.510, 42.520, 42.530, 42.540, 42.550, 42.560, 42.570, 42.580

### *Approved Options*

The equivalent of 1.0 credit of approved courses which may be selected from among those offered by the School and in related disciplines.

## **Thesis**

\* Business 42.599

The M.M.S. thesis is equivalent to 1.5 credits. The thesis normally relates to issues that are relevant to producers and users of technology.

The thesis must represent the result of the candidate's independent research undertaken after being admitted to graduate studies at Carleton University's School of Business. Previous work of the candidate may be used only as introductory or background material for the thesis.

A candidate may carry on research work related to the thesis off campus provided that the work is approved in advance and arrangements have been made for regular supervision of thesis research activities with the School's supervisor of graduate studies.

All students require the School's approval for their proposed thesis topic.

Each candidate submitting a thesis will be required to take an oral examination on the subject of the thesis.

## **Research Project**

\* Business 42.598

The M.M.S. research project is equivalent to 0.5 credit. The research project normally focuses on a business problem and should involve one or more of the following components: problem analysis and research design; library research and critical analysis; data col-

lection and data analysis. The research project will be carried out under the direct supervision of one or more faculty members of the School. All students require the School's approval for their proposed research project topic. Each candidate submitting a research project will be required to submit a formal research report for evaluation.

## **Academic Standing**

A grade of B- or better must normally be obtained in each credit counted towards the degree. A candidate may, with the recommendation of the School and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in 1.0 credit (or the equivalent).

## **Doctor of Philosophy**

The focus of the Ph.D. program in Management is applied and basic research on complex management problems in a rapidly changing and globally oriented environment. The doctoral program in management is designed to develop graduates skilled in research with both a theoretical and practical understanding of the complex problems of business and managers. These graduates will pursue careers in university education and research, in training and research in private and public sector organizations, and in business management.

The program is designed to accomplish its objectives by its orientation to a holistic, integrative, and discipline-supported approach to management problem-solving, focused on critical issues facing managers in organizations in both the private and public sectors.

The degree will normally be pursued on a full-time basis for the first two years.

## **Admission Requirements**

Admission into the Ph.D. program will be judged primarily on the applicant's ability to undertake research successfully and his/her prospects for completion of the program. Admission to the Ph.D. program is governed by the requirements stated in the General Regulations section of this Calendar.

The normal requirement for admission to the doctoral program in management is a master's degree (or equivalent) in business or a related field with an A- average. A number of years of work experience is desirable.

A student enrolled in the M.M.S. program (or a similar research-based master's program in business) who has completed a minimum of 2.5 credits and who has shown outstanding academic performance and research promise

may be admitted to the Ph.D. program without completing the master's program. Normal Ph.D. program requirements, as stated below, will apply. Each case will be considered on an individual basis for advanced standing in the Ph.D. program. Advanced standing will be considered for a maximum of 1.5 credits.

Applicants who have completed a thesis-based master's program in business or a related area may have their program requirements, as set out below, adjusted at the time of admission.

All Ph.D. candidates, regardless of their previous field of specialization, are expected to have or to acquire a basic knowledge of statistics and at least two of the following areas of management: finance, marketing, organizational behaviour, management science, information systems, and productions/operations management. Students will be admitted to the program with a course of study designed where appropriate to supplement previous education, experience, and training.

The School requires that all applicants submit scores obtained in the Graduate Management Admission Test (GMAT) offered by the Education Testing Service of Princeton, New Jersey. A superior GMAT score will be required for consideration for admission. All applicants whose native tongue is not English must be tested for proficiency in the English language and obtain a minimum score of 550 on the TOEFL.

### Program Requirements

The program requirements for the Ph.D. in Management are:

- \* 10.0 credits comprised of the following: 1.5 credits in research and analysis methods; 1.5 credits of seminar courses in functional areas of business; 1.0 credit from a selection of advanced course electives in the School of Business; and 1.0 credit of free electives which must be approved by the thesis supervisor
- \* A thesis normally equivalent to 5.0 of the 10.0 required credits, which must be defended at an oral examination
- \* Two written and oral comprehensive examinations
- \* Participation in the School of Business seminar series on current business issues for one year
- \* Participation in a seminar series on, and classroom experience in, teaching methods
- \* Presentation and oral defence of the thesis proposal

### Course Requirements

All students in the doctoral program are required to successfully complete:

The following 0.5 credit courses:

\* Business 42.692, 42.697 and either 42.695 or 42.696. Note: Students who have not successfully completed Business 42.593 (or the equivalent) must do so before enrolling in Business 42.695.

\* 1.5 credits of advanced seminars including at least one two-course sequence, from the following doctoral seminar courses: Business 42.610 and 42.611; 42.620 and 42.621; 42.630 and 42.631; 42.640 and 42.641; 42.650 and 42.651.

\* 1.0 credit from the following list of advanced seminars: Business 42.671; 42.672; 42.673; 42.674; 42.681; 42.682; 42.683; 42.684; 42.685.

Students are strongly encouraged to complete 0.5 credit chosen from Business 42.671, 42.672, 42.673, or 42.674, a series of courses which focuses on the dimensions of complex problem representation and analysis. Students are also strongly encouraged to complete 0.5 credit chosen from Business 42.681, 42.682, 42.683, 42.684, or 42.685, a series of courses oriented to specific management issues.

The remaining 1.0 credit elective, chosen with the approval of the thesis supervisor to assist in the thesis research process, will normally be chosen from either those courses at the 500- or 600-level in the School of Business listed above, or from outside the School in a supporting discipline or in the area of statistics.

### Thesis

All Ph.D. candidates are required to successfully complete a thesis normally equivalent to a minimum of 5.0 credits on a topic approved by the School. Students with appropriate background will be reviewed for possible adjustment of thesis weight.

### Comprehensive Examinations

All Ph.D. candidates are required to successfully complete two written and two oral examinations. One of these examinations will normally cover the functional area specialization of the student. The other examination will normally test the student's ability to integrate and apply knowledge to significant issues in management. The issues dealt with will be distinct from the thesis topic of the student.

The written comprehensive examination may take the form of two major essays, or one

major essay and one research grant proposal developed for submission to an agency outside the School. The submission of each essay or grant proposal will be followed within one to three weeks by a comprehensive oral examination, which is not restricted to issues raised by the written portion.

The comprehensive examinations must be completed successfully before the Ph.D. proposal defence is scheduled. In normal circumstances, one oral defence must occur within four calendar terms of the student's initial registration in the Ph.D. program. The second must be defended within six calendar terms of initial registration. Students who do not fulfil this requirement may be asked to withdraw from the program.

### Academic Standing

Doctoral students must normally obtain a grade of B- or better in each credit, and Satisfactory on the comprehensive examinations, the Ph.D. thesis and its oral defence.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Enrolment in graduate courses requires the permission of the School through the supervisor of graduate studies.

Business 42.510F1

#### Seminar in Management

An examination of research on management issues and practices in modern organizations. The course will analyze and integrate both the micro and macro aspects of organizational behaviour.

Business 42.511W1

#### Current Topics in Organizational Design

A critical analysis of organizational design implications of high rates of environmental and technological change. New management structures, processes and technologies, with potential for enhancing productivity and quality will be evaluated.

Business 42.520F1

#### Seminar in Marketing

This course examines issues in productivity and innovation as they relate to marketing.

The course assumes the viewpoint of product portfolio management, and addresses problems such as market assessment, marketing audits and policy, new products, existing product management, and product line profitability. Particular emphasis is placed on marketing of technology-based products and the effect of technological developments on marketing practices.

Business 42.521W1

#### Contemporary Marketing Thought

This course examines the state of the art in marketing thought, and prepares the student to cope with an ever changing environment. Topics include the development of paradigms in marketing, recent advances in consumer behaviour, the acquisition of data and information from the external environment, the influence of societal and environmental developments upon marketing, and new directions in marketing theory and practice.

Business 42.530F1

#### Managing the Multinational Enterprise

This course examines issues in the management of multinational enterprises, e.g., optimizing productivity in multi-site environments, the dispersion of innovative products and ideas across national boundaries, international strategic planning, the selection of markets and modes of expansion, and the management of cultural differences and their impact on the basic managerial functions of communication, planning, decision-making, and integration. The course will examine both Canadian-based multinational firms and externally-based firms with interests in Canada.

Business 42.531W1

#### Seminar in International Business Management

This course examines specific topics in the area of international business management. Areas of interest include management in inter-cultural environment, issues in international financing and marketing, business negotiations, international inter-firm alliances including joint ventures, and the role of free trade areas in international business. Students will be expected to make significant contribution to the discussion.

Business 42.540F1

#### Seminar in Information Systems Management

This course is concerned with major issues in the management of information technology. It covers the following major topics: organization of information services, planning, management, and administration of information resources, assimilation and diffusion of information technology, integration of infor-



mation services; and current opportunities and concerns in information services.

Business 42.541W1

### **Current Topics in Business Information Systems**

This course examines trends and issues associated with business information systems within organizations. It covers topics such as analysis and design of information systems, end-user computing, databases, distributed systems, teleprocessing, office automation, data communications. Other topics may include modern technologies such as knowledge-based systems and artificial intelligence.

Business 42.550F1

### **Seminar in Finance**

An analysis of contemporary theory of finance. This analysis includes: the examination of innovations in corporate financing, financial planning, financing strategies, valuation of contingent claims, implications of agency theory, etc. Particular emphasis is placed on financial decision of technology-based firms.

Business 42.551W1

### **Current Topics in Financial Research**

This course examines research and empirical issues in investments, portfolio management, corporate finance, and capital markets. Particular emphasis will be placed on innovative research methods and financial innovations.

Business 42.560F1

### **Seminar in Production and Operations Management**

This is an introduction to the philosophies, methods, and techniques of modern production and operations management. It discusses long run design issues involving products, plants, equipment, layout, work organization, and their interrelations. It also looks into medium- and short-term operational questions involving the planning and control of production, inventories, and product quality. The theoretical material will be grounded in problems, cases, and project work.

Prerequisite: Graduate standing with Business 42.337 or the equivalent.

Business 42.561W1

### **Strategic Management of Manufacturing Technology and Productivity**

This is a case-analysis course intended for students interested in strategy, productivity, and technology in manufacturing operations. The course focuses on articulating and executing the manufacturing strategies related to structural kinds of changes in facilities, locations, production technologies, and sourcing arrangements, and the infrastructural kinds of changes in management policies and practices. Other topics include adoption and implementation of new technologies and interaction between

research and development, engineering and operations.

Prerequisite: Graduate standing with Business 42.337 or the equivalent.

Business 42.570F1

### **Seminar in Management of Research and Development**

Examines the mission of research and development and the management of research and development groups. The focus is on the creation of technology and its deployment. Topics include specific managerial problems around the management of design and development activities, and the basic and applied research which support these activities.

Prerequisite: Graduate standing with Business 42.337 or the equivalent.

Business 42.571W1

### **Current Topics in Research and Development and Innovation Diffusion**

The course deals with the concepts, theories, and methods of efficiently managing the technological innovation cycle, the innovation monitoring system incorporating the critical factors that signal the possible success or failure of a developing project, quality in research and development, theories of adoption of an innovation in a firm, and the models of the diffusion of an innovation. Other topics relevant to research and development and innovation diffusion include the role technology monitoring and forecasting play in long-range planning decisions and the methodologies to perform these activities, transfer of technology, and the role of government supporting the innovation.

Business 42.580F1

### **Seminar in Decision Analysis**

The course deals with analyzing decisions and the assessment of the relative quality of management systems by examining the quality of the decisions that they make. The topics covered include decision making, decision modeling and management science, problem representation, expected utility theory, multi-attribute utility theory, value and utility measurement. All the theoretical concepts will be illustrated with intuitive examples and practical applications.

Business 42.590T1 or T2

### **Tutorials/Directed Studies in Business**

Tutorials or directed readings in selected areas of business, involving presentation of papers as the basis for discussion with the tutor. A requirement for the course may be participation in an advanced business course at the undergraduate level.

Business 42.592F1

### **Business Research Methods**

A consideration of the basic issues of science



tific research as applied to business problems. The course includes a discussion of the logic of scientific research, proof and verification, hypothesis testing, the logic of statistical inference, and research design.

**Business 42.593F1**

**Multivariate Statistics for Business Research**

This course involves an in-depth study of some of the methods of multivariate statistics most frequently encountered in business research. The course begins with multiple regression, including regression diagnostics, and proceeds through multivariate analysis of variance, discriminant analysis, factor analysis, and cluster analysis. There is a strong focus on the assumptions underlying each technique, and methods for assessing assumptions and coping with violations will be stressed. A specific objective of the course is to provide students with the background necessary for studying more specialized topics in business statistics, such as time series analysis and multidimensional scaling. Students will develop practical skills in data analysis by using statistical packages to analyze real datasets, compiled by researchers at the School of Business. This course is not available for credit for students registered in programs offered by the Department of Mathematics and Statistics.

**Business 42.597W1, S1**

**M.M.S. Thesis Tutorial**

A seminar designed to help the student formulate and evaluate specific research topics. The successful submission of a thesis proposal is necessary for the completion of the course.

**Business 42.598F1, W1, S1**

**M.M.S. Research Project**

**Business 42.599F3, W3, S3**

**M.M.S. Thesis Research**

Prerequisite: Business 42.597.

**Business 42.610F1 or W1**

**Seminar in Organizational Behaviour I: Modern Organization Theory**

The development of post-structuralist organizational theory is examined. Theories of organizational culture and symbolism, political theories of organization, ethnomethodological, decision based and population ecology approaches are investigated. The social, economic, and intellectual forces shaping organization theory provides a major focus.

**Business 42.611F1 or W1**

**Seminar in Organizational Behaviour II: Topics in Organizational Behaviour**

The study of individual and group behaviour in organizations continues to expand both in the areas covered and the theoretical ap-

proaches employed. In this seminar selected topics are analyzed in detail. Potential topics include leadership, small group behaviour, management of conflict, effective supervision, organizational control, and work group structures.

**Business 42.620F1 or W1**

**Seminar in Marketing I**

This seminar focuses on marketing theory, its history and current development through the analysis, synthesis, and extension of published theoretical and empirical papers on such topics as: the marketing concept, the role of marketing in various types of organizations, defining and segmenting markets, managing new product introductions, managing established products, and marketing planning.

**Business 42.621F1 or W1**

**Seminar in Marketing II**

This seminar focuses on marketing decision-making practice and theory in business and not-for-profit organizations in such areas as consumer decision-making, organizational decision-making, analytical methods, and research methods to aid in marketing decision-making.

**Business 42.630F1 or W1**

**Seminar in Management of Production/Operations I: Strategic Management of Production Systems**

The course focuses on developing the firm's strategies with respect to facilities, locations, production technologies, and sourcing arrangements. It also discusses recent developments in management policies and practices used by companies to enable their production system to operate at its full potential in the wake of time- and quality-based competition.

**Business 42.631F1 or W1**

**Seminar in Management of Production/Operations II: Production/Technology/Strategy Interface**

This course deals with strategy, productivity, and technology in the production environment. The focus is on the evolution and the management of process innovation; management of productivity using production technologies; integration of production strategy and technology; interaction between research, development, engineering, and operations, including topics such as quality function deployment and the deployment of process innovations.

**Business 42.640F1 or W1**

**Seminar in Information Systems I: Information and Computing Technologies in Management**

This course deals with the role of computing and communication technologies and information systems in the functioning of organi-

zations and managers. This seminar introduces such technologies as wide- and local-area networks, distributed systems, distributed databases, telecommuting, electronic mail and on-line information services, management and executive information systems, decision support systems, organization information systems, multi-media, intelligent decision systems, and knowledge-based systems.

Business 42.641F1 or W1

### **Seminar in Information Systems II: Analysis and Design of Information Systems**

This course examines theory and practice concerning the factors determining the effective and efficient use of computing technologies, particularly on the match between the information system and its users. Emphasis is placed on the use of system science to provide a rigorous and comprehensive approach to requirement analysis, design and implementation techniques to shape the information flow and communication between organizations and individuals.

Business 42.650F1 or W1

### **Seminar in Finance I**

The objective of the course is to integrate topics in financial theory so as to facilitate a broader understanding of the area. Specific topics to be covered in any year are chosen with the interests of students and new developments in theory in mind, and may include theory of options, futures and forwards pricing theory, asymmetric information and corporate finance, agency theory, concepts in economic efficiency, and also more recent empirical methods, such as GMM, ARCH, GARCH, etc.

Business 42.651F1 or W1

### **Seminar in Finance II**

A special topics seminar course in finance designed to expose students to emerging areas in finance, such as total quality management, left-hand financing, activity-based costing, multi-criteria decision-making, neural networks in financial managements, etc. Integrative problems spanning two or more functional disciplines in management, such as taxation, are also explored.

Business 42.671F1 or W1

### **Choice Behaviour**

The basic objective of this course is to present an understanding of choice behaviour from the perspective of a variety of disciplines. Topics covered may include: a review of individual choice behaviour models in economics, Von-Neumann-Morgenstern utility, Luce Choice Axiom and its extensions, multi-criteria individual choice behaviour, and multi-criteria group choice behaviour.

Business 42.672F1 or W1

### **Analysis and Representation of Complex Problems**

This course uses both qualitative and quantitative techniques and theoretical frameworks to represent organizational systems, problems and decisions that executives and managers face. It introduces methodologies in symbolic representations or adaptive and learning systems. The qualitative models are viewed as primary, providing the setting for the quantitative models, selection of choice mechanism, and interpretation of solutions.

Business 42.673F1 or W1

### **Systems Concepts in Management**

The objective of this course is to develop an ability to deal with reality as a system — specifying system variables, components, boundaries, and limitations. A unified outlook towards modern management theory and practice, management systems, and computer-based information systems is developed. Topics to be studied include: analysis of managerial-organizational systems as adaptive and learning-responsive systems, gestalt views of firm-environment interaction and the open system paradigm, model building and use, managerial decision-making, and systems thinking in the context of the organizational functions of planning and control.

Business 42.674F1 or W1

### **Managing the Change Process**

The process of organizational change is analyzed through an examination of both the process of change within the organization and the external forces which drive change. Emphasis is placed on the roles taken by internal and external agents in forecasting, understanding, and managing change. Topics include sources of environmental change, change agent theory, the impact of government policy, and resistance to change.

Business 42.681F1 or W1

### **Management of Technology**

Introduction to issues in the management of technology. Topics include: technology strategy and policy, technology forecasting and planning, the process of technology innovation from concept to market, research and development management, technology adoption, diffusion and implementation, technology transfer, and technology and social issues.

Business 42.682F1 or W1

### **Women in Management**

This course explores the research and organizational challenges arising from changing gender roles and the increased participation of women in management. Topics include: the sex segregation of work, gender differences

in communication and management styles, work-family conflict, women's careers, managing sexual harassment, employment equity, and pay equity. The implications for managing a more diverse workforce are discussed.

Business 42.683F1 or W1

### **Corporate Strategy and Policy**

This course focuses on corporate strategic planning, strategy formulation and implementation, and the interface between business, government, and other elements in the environment. The course serves to integrate and synthesize knowledge acquired in the functional disciplines of business by application of functional skills to corporate planning and strategic decision-making. The course examines the history, stage of development and future directions of practice and research in the field.

Business 42.684F1 or W1

### **International Business Strategy**

An advanced examination of contemporary theory focusing on the international expansion of firms. Topics include: trade and investment flow interactions in global markets, location theory and retrenchment trends, mode of entry, market selection, and sequential expansion issues, the globalization paradigm versus the EPRG Framework in the context of international consumer behaviour theory, trans-border data and financial flows, internationalization theory in small, medium-sized, and large firms, expansion methods and issues including strategic alliances, free trade zones, trade blocs and free trade areas, and consortia.

Business 42.685F1 or W1

### **Canadian Business Competitiveness**

Competitiveness at the country, industry, and firm levels is studied in the context of Canada's unique characteristics. The central theme is examined from various domestic and international perspectives including: industrial organization theory, antecedents and evolution of Canadian business, comparative perspectives on industrial concentration, internalization theory, Porter's competitiveness diamond, role of foreign firms in Canada and performance of Canadian firms abroad, business-government interactions in a decentralized federal state, and antecedents, role, and impact of government support programs for business.

Business 42.690F1, W1, S1

### **Directed Readings**

Directed readings in selected areas of business, involving presentation of papers as the basis for discussion. A part of the requirement for the course may be participation in an advanced course at the undergraduate/graduate level.

Prerequisite: Permission of the School.

Business 42.691F1, W1, S1

### **Special Topics**

Designed to expose students to new and emerging issues in selected areas of business research. Integrative problems involving two or more areas of business research are also explored. The topics covered may vary from year to year.

Prerequisite: Permission of the School.

Business 42.692F1 or W1

### **Research Methodology in Business**

The study of research techniques commonly used in research on business and management issues. The development of knowledge of these methodologies and their application, as well as their possible use in the thesis research of the student are the two main goals of this course.

Business 42.695F1 or W1

### **Advanced Statistical Methods for Business Research**

A practical introduction to advanced statistical methods used in business research, with particular focus on discrete categorical data. Topics include the analysis of two-way and three-way tables; loglinear modelling; logistic regression; generalized linear models. Students will analyze real data using appropriate software packages.

Business 42.696F1 or W1

### **Advanced Methods and Models of Management Science**

This course involves the study of advanced topics of decision-making under certainty and uncertainty. Students study the issues of building complex constrained and unconstrained optimization models, project management, job-shop scheduling, facilities location, and problems of a discrete choice. They also become familiar with multi-objective dynamic programming, evaluation of discrete alternatives, and multi-attribute utility theory. The course explores the direct links between theoretical developments and practical applications through the use of case studies or applied modeling.

Business 42.697F1, W1, S1

### **Ph.D. Thesis Tutorial**

An intensive preparation for Ph.D. thesis research, under the direction of one or more members of the School. The successful submission of a thesis proposal is necessary for the completion of the course.

Business 42.698F2, W2, S2

### **Ph.D. Comprehensives**

Preparation for comprehensive examinations.

Business 42.699F, W, S

### **Ph.D. Thesis**



## Canadian Studies

Dunton Tower 1206  
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 Fax: 520-3903  
 E-mail: [canadian\\_studies@carleton.ca](mailto:canadian_studies@carleton.ca)

### The School

**Director of the School**, Pat Armstrong

**Graduate Supervisor and Coordinator, Heritage Conservation**, Julian Smith

**Coordinator, Canadian Women's Studies**, Katherine Arnup

**Coordinator, Northern and Native Studies**, Madeleine Dion Stout

**Undergraduate Supervisor and Coordinator, Cultural Studies**, Stan McMullin

**Coordinator, Advanced Summer School**, Pat Armstrong

**Assistant Professor of Canadian Studies**, Pauline Rankin

**Associate Professor of English**, Parker Duchemin

**Associate Professor of Law**, Maureen H. Davies

**Adjunct Professors**, John B. Carroll, David C. Hawkes

**Adjunct Research Professors**, Rt. Honourable Joe Clark, Heather Menzies, James Page

**Fellows**, Richard T. Clippingdale, H. Blair Neatby

The School of Canadian Studies offers a program of study and research leading to the degree of Master of Arts in Canadian Studies.

The work of the School is conducted with the assistance of faculty and availability of course work in a variety of supporting departments including: Architecture, Art History, Economics, English, Film Studies, French, Geography, History, Journalism and Communication, Law, Linguistics and Applied Language Studies, Music, Political Economy, Political Science, Psychology, Public Administration, Religion, Social Work, Sociology and Anthropology, and Women's Studies.

The Canadian Studies program is interdisciplinary in emphasis. It enables students in the School to develop individual areas of concentration to meet particular interests in a broad range of Canadian issues.

The proximity of Carleton University to the National Library, the National Gallery of Canada, the national museums, the Library of Parliament, the National Archives of Canada, Statistics Canada, and the libraries of various government departments and embassies ensures excellent research facilities for graduate candidates in Canadian Studies.

With the aid of a grant from the Donner Foundation, the School initiated a program area of northern and Native studies in 1982. The same conditions and requirements apply as in other program areas; however, special consideration may be given to candidates for admission who have extensive knowledge of the north or of Native peoples, and the language requirement may be met by a demonstrated knowledge of an Aboriginal language in addition to English or French.

In 1983-84, a women's studies program area was instituted. Both interdisciplinary and comparative in focus, the program permits students to examine the interplay within the Canadian context between gender and race, gender and nationality, gender and class, and sex/gender as a dynamic principle in the process of imperialism, nation building, and the construction of national and ethnic identities.

Since 1986, the School has offered a program area in Canadian culture and cultural policy. Students with a broad interest in traditional and popular culture, music, art, film, literature, and performing arts will find the program's interdisciplinary approach to cultural theory and practice of great value.

A program area in heritage conservation began in 1989-90. With an interdisciplinary focus on the Canadian natural and built environment, the program permits the course of study to be tailored to individual interest and backgrounds. The School of Architecture, the Department of Leisure Studies at Ottawa University, the Heritage Canada Foundation, and the Canadian Parks Service at Environment Canada cooperate in offering the program.

The School also runs an advanced summer program from mid-May to mid-August. The format includes credit and non-credit courses, seminars, and public events. Write to the School of Canadian Studies for information about the Summer of 1999 offering.

### Qualifying-Year Program

Applicants who do not qualify for direct admission to the master's program may, in exceptional cases, be admitted to a qualifying-year program. However, admission to the qualifying-year program does not imply automatic

admission to the master's program. At the end of the qualifying-year program the student will be required to apply for entry into the master's program, at which time the School will determine the student's eligibility to enter the program.

## Master of Arts

### Admission Requirements

Applicants must normally hold an Honours B.A. (or the equivalent), with at least high honours standing, in one of the disciplines represented in the School. Applicants wishing to be considered for financial assistance from Carleton University are advised to submit completed applications to the School by February 1 since enrolment in the School is limited.

### Language Requirement

The School requires a reading knowledge of French. This requirement may be satisfied in the following ways:

- \* Successful completion of a 100-level French course or its equivalent, preferably French 20.106
- \* Successful completion of a French language examination
- \* Alternatively, a student may fulfill this requirement with a demonstrated knowledge of an Aboriginal language.

The School conducts the French language examinations in September and January. Students choosing the first option should note that examination results in these courses form part of their record, although they are additional to the course requirements for the degree.

### Program Requirements

The minimum requirements for the master's program are outlined in the General Regulations section of this Calendar (see p. 56). The School of Canadian Studies specifies that all candidates must select one of the following program patterns:

- \* 3.0 credits, a thesis, and an oral examination
- \* 4.0 credits, and a research essay
- \* 5.0 credits, and a comprehensive examination in two parts; part one based on 12.501, and part two based on one of 12.510, 12.520, 12.530, or 12.540

Whichever pattern is selected, all students in the master's program are required to take 12.501 and one of 12.510, 12.520, 12.530, or 12.540.

## Comprehensive Examinations

A committee will be assigned on entrance to each candidate choosing the 5.0 credit course option to advise and assist in the preparation for the comprehensive examination. The comprehensive examination will normally be written but may, with the approval of the graduate supervisor, be oral. The comprehensive examination will normally be undertaken in the academic year in which the student completes 12.501, but, with the approval of the graduate supervisor, may be undertaken at a later point in the student's program.

## Thesis/Research Essay Proposal

Students are required to file with the School a detailed proposal of their thesis or research essay project no later than the end of the second term of registration for students enrolled full-time, and no later than the end of the fifth term of registration for students enrolled part-time. Students failing to file a proposal may not be permitted to register in subsequent terms until this requirement has been met. Approval of proposals shall be the responsibility of the student's intended thesis/research essay supervisor, the graduate supervisor of the School, and the program area coordinator.

## Special Course Offerings in Heritage Conservation Program Area

The School of Architecture offers two workshops in support of the Heritage Conservation Program Area. Students may take these courses as part of their M.A. requirements in Canadian Studies:

- \* Architecture 77.541F1,W1,S1
- \* Architecture 78.542F1,W1,S1

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

FW,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

Students not registered in the M.A. program in the School of Canadian Studies may take interdisciplinary seminars with the permission of the School.

Canadian Studies 12.501F1, W1 or S1

**Modern Concepts of Canada**

Interdisciplinary Seminar. Topic varies from year to year depending on instructor.

Prerequisite: Graduate standing in the School.

Canadian Studies 12.502F1, W1, or S1

**Interdisciplinary Methods**

A survey of the issues raised by problem-directed methodologies; critiques of existing methodology including from the standpoints of feminist and native scholarship.

Prerequisite: Canadian Studies 12.501.

Canadian Studies 12.503F1, W1, S1

**Selected Topics in Canadian Studies**

Topic varies from year to year.

Canadian Studies 12.510T2

**Northern and Native Issues**

Interdisciplinary seminar. The significance of the north to Canada, and the position of Native people in Canadian society. The impact of resource development and modern technology on both the north and Native people.

Canadian Studies 12.520T2

**Women's Studies**

Interdisciplinary seminar. The significance in the Canadian experience of sex/gender in the dynamics of imperialism, nation building, class differentiation, and the construction of culture. Canadian feminist theory and the history of women's movements.

Canadian Studies 12.521F1, W1, S1

**Collective Identities in Canadian Societies**

An interdisciplinary examination of the relationships and conflicts among sex/gender, race, language, ethnicity and nation. Particular emphasis will be given to gendered understandings of racism, nationalism, regionalism, and multi-culturalism; and to conflicts between individuals and collective rights claims.

Canadian Studies 12.530T2

**Canadian Culture and Cultural Policy**

Interdisciplinary seminar. The nature of Canadian culture and purposes, activities, and impact of the principal Canadian institutions, agencies, and systems involved with cultural production, in both English- and French-language dimensions.

Canadian Studies 12.540T2

**Canadian Heritage Conservation**

An interdisciplinary seminar providing an introduction to the cultural, economic, legal, political, and technical aspects of the conservation of heritage resources. Particular attention will be given to the elements of the built environment, buildings, complexes, landscapes, and urban areas, along with their associated artifacts.

Canadian Studies 12.580T2

**Internship/Practicum**

Internships or practicum placements in an institutional setting outside of the University. Students are required to complete a formal written paper in addition to their internship/practicum activities. The written work is evaluated jointly by the student's internal and external advisers. Students are advised to apply to the graduate supervisor no later than a month prior to the beginning of the term in which placement is desired.

Canadian Studies 12.581F1, S1

**Internship/Practicum**

Internships or practicum placements in an institutional setting outside of the University. Students are required to complete a formal written paper in addition to their internship/practicum activities. The written work is evaluated jointly by the student's internal and external advisers. Students are advised to apply to the graduate supervisor no later than a month prior to the beginning of the term in which placement is desired.

Canadian Studies 12.582W1, S1

**Internship/Practicum**

Internships and practicum placements in an institutional setting outside of the University. Students are required to complete a formal written paper in addition to their internship/practicum activities. The written work is evaluated jointly by the student's internal and external advisers. Students are advised to apply to the graduate supervisor no later than a month prior to the beginning of the term in which placement is desired.

Canadian Studies 12.590T2, S2

**Directed Studies**

Reading and research tutorials. A program of reading and preparation of written work supervised by a qualified adviser, in an area not covered by an existing seminar. Students are advised to apply to the graduate supervisor no later than a month prior to the beginning of the term in which the directed studies is to take place. Only 1.0 credit of directed studies tutorial can be used towards completion of the degree.

Canadian Studies 12.591F1, W1, S1

**Directed Studies**

Reading and research tutorials. A program of reading and preparation of written work supervised by a qualified adviser, in an area not covered by an existing seminar. Students are advised to apply to the graduate supervisor no later than a month prior to the beginning of the term in which the directed studies is to take place. Only 1.0 credit of directed studies tutorial can be used towards completion of the degree.



**Canadian Studies 12.592T2, S2**

**Directed Studies**

Reading and research tutorials. A program of reading and preparation of written work supervised by a qualified adviser, in an area not covered by an existing seminar. Students are advised to apply to the graduate supervisor no later than a month prior to the beginning of the term in which the directed studies is to take place. Only 1.0 credit of directed studies tutorial can be used towards completion of the degree.

**Canadian Studies 12.593F1, W1, S1**

**Directed Studies**

Reading and research tutorials. A program of reading and preparation of written work supervised by a qualified adviser, in an area not covered by an existing seminar. Students are advised to apply to the graduate supervisor no later than a month prior to the beginning of the term in which the directed studies is to take place. Only 1.0 credit of directed studies tutorial can be used towards completion of the degree.

**Canadian Studies 12.598F2, W2, S2**

**Research Essay**

**Canadian Studies 12.599F4, W4, S4**

**M.A. Thesis**

**Selection of Courses**

In addition to the graduate courses offered by the School, the following courses are of particular relevance to students in Canadian Studies. The list is not exclusive and is subject to change. Other courses may qualify if the particular professor teaching the course includes substantial Canadian content. Permission of the Graduate Supervisor is required for these courses. Students in the master's program in the School must complete at least 4.0 credits, at the 500- level, with the possibility of 1.0 credit at the 400- level.

*Note:* Students should be aware that the number of spaces in graduate courses offered by other departments may be limited, and that registration may be conditional upon obtaining the prior approval of the department concerned. It is the responsibility of the student to ensure that permission is obtained from the appropriate department prior to registering in any of the department's courses.

*Anthropology*

54.470 Selected Problems in the Study of North American Native Peoples

54.516, 54.517, 54.538

*Architecture*

76.423 Society and Shelter

76.425 Workshop: User Analysis and Building Performance

77.440 Design for Construction

76.500, 76.501, 76.502, 77.541, 78.542

*Art History*

11.400 Topics in Canadian Art: Art of the Land

11.405 Historic Dress Traditions of Canadian Indian Peoples

11.461 Topics in Twentieth-Century Art: Women Artists and Modernism in Europe and America

11.480 Readings in Twentieth-Century Architectural History

11.490 Directed Readings and Research

11.491 Directed Readings and Research

11.492 Directed Readings and Research

11.500, 11.501, 11.502, 11.511, 11.523

*Comparative Literary Studies*

17.532, 17.558

*Economics*

43.436 Employment Economics and Labour Policy

43.465 Industrial Relations

43.480 Urban Economics

43.531, 43.532, 43.533, 43.535, 43.541, 43.542, 43.581, 43.582

*English Language and Literature*

18.482 Studies in Canadian Ethnic Minority Language

18.483 Studies in the Literature of Quebec and English Canada

18.486 Studies in Canadian Literature I

18.487 Studies in Canadian Literature II

18.488 Canadian Writing and the Literatures of the First Nations

18.581, 18.582, 18.583, 18.585, 18.587, 18.589

*Film Studies*

19.528, 19.529

*French*

20.550, 20.570

*Geography*

45.423 Urban Revitalization

45.427 Urban Development and Analysis

45.431 Advanced Cultural Geography

45.435 Historical Geography

45.447 Canadian Agriculture

45.541, 45.543, 45.545, 45.570, 45.572, 45.573

### *History*

24.421 Science and Technology in the Canadian Experience

24.422 The Maritimes in Transition, 1870s to 1920s

24.424 Canadian Immigration and Ethnic History

24.426 Perspectives on State Formation in Canada

24.430 Colonial Society in British North America

24.431 Canada from Confederation to the Great War

24.433 Selected Problems in Canadian Business History, 1850-1980

24.434 History of Northern Canada

24.437 Canada From War to War

24.438 Studies in the History of Popular Culture

24.439 Modern Canada Since 1939

24.454 Selected Problems in the History of Women and the Family: The Pre-Industrial Atlantic World

24.459 Selected Problems in the History of Women and the Family: From the Industrial Revolution

24.500, 24.525, 24.526, 24.529, 24.530, 24.531, 24.532, 24.533, 24.534, 24.535, 24.536, 24.537, 24.556, 24.559, 24.588

### *Journalism and Communication*

28.500, 28.535, 28.541, 28.550

### *Law*

51.401 Law, Family and Gender

51.402 Feminist Theories of Law

51.417 Law in Advanced Capitalist Society

51.439 Criminal Proceedings and Dissent: Political Offences And National Security Measures

51.445 Labour Relations in the Public Service

51.451 Selected Problems in Comparative Constitutional Law

51.454 Aboriginal Peoples and the Canadian Criminal Legal System

51.457 Administrative Law and Control

51.487 Quebec Civil Law

51.502, 51.507, 51.508, 51.532, 51.545, 51.550, 51.553, 51.590, 51.591, 51.593, 51.594

### *Mass Communication*

27.410 Selected Topics in Mass Communication Analysis

27.412 Selected Topics in Mass Communication Analysis

27.450 Mass Media and Capitalist Democracy I

27.451 Mass Media and Capitalist Democracy II

27.521, 27.523, 27.525, 27.531, 27.555, 27.556, 27.557, 27.558, 27.559, 27.565

### *Music*

30.501, 30.505, 30.510, 30.511, 30.512, 30.515

### *Political Science*

47.400 Topics in Canadian Government and Politics

47.402 Policy Seminar: Problems of Northern Development

47.403 Politics and the Media

47.405 Unity, Disunity and Federalism

47.406 Legislative Process in Canada

47.407 The Politics of Law Enforcement in Canada

47.408 National Security and Intelligence in the Modern State

47.409 Quebec Politics

47.410 Canadian and Comparative Local Government and Politics

47.411 French-English Relations

47.416 Labour and the Canadian State

47.417 Political Participation in Canada

47.418 Canadian Provincial Government and Politics

47.419 The Politics of the Canadian Charter of Rights and Freedoms

47.424 Elections

47.441 Business-Government Relations in Canada

47.503, 47.500, 47.506, 47.507, 47.508, 47.509, 47.510, 47.511, 47.520, 47.521, 47.536, 47.537, 47.541, 47.557, 47.561, 47.600, 47.601

### *Public Administration*

50.500, 50.504, 50.506, 50.508, 50.509, 50.516, 50.519, 50.525, 50.536, 50.538, 50.560, 50.564, 50.567, 50.571, 50.574, 50.584, 50.586, 50.589

### *Social Work*

52.412 Aboriginal Peoples and Social Policy

52.413 Practice and Policy in Immigration

52.423 Social Work Practice from an  
Aboriginal Perspective

52.424 Social Work and Aging

52.510, 52.511, 52.512, 52.515, 52.516, 52.518,  
52.527, 52.531, 52.532, 52.574

*Sociology*

53.451 Workshop in Demography/Human  
Ecology

53.452 Workshop on Work and Organizations

53.525, 53.532, 53.538, 53.540, 53.545, 53.568.

*Women's Studies*

09.491 Selected Topics in Women's Studies I

09.492 Selected Topics in Women's Studies II

09.500, 09.501



## The Ottawa-Carleton Chemistry Institute

2240 Herzberg Building  
Telephone: 520-3515  
Fax: 520-2569



### The Institute

**Director of the Institute, R.J. Crutchley**

**Associate Director of the Institute, To be announced**

The Ottawa-Carleton Chemistry Institute, established in 1981, is a joint program of graduate studies and research in chemistry for Carleton University and the University of Ottawa. The Institute combines the research strengths and resources of the Departments of Chemistry at both campuses. Research facilities are shared and include: a major mass spectrometry centre, X-ray spectrometer, several modern NMR spectrometers, a pico-second laser facility, an ultratrace analysis laboratory, and an electrochemical research centre. In addition, the resources of many federal departments are available to graduate students, including the National Research Council and its library, the National Science Library (CISTI), and departments of Health and Welfare and Agriculture.

The Institute offers the M.Sc. and Ph.D. degrees in all areas of chemistry, including biochemistry, analytical, inorganic, organic, physical and theoretical chemistry. All thesis, seminar and examination requirements may be met in either English or French. Students will be enrolled at the campus where the research supervisor is located. Several graduate students also conduct their research off campus under the supervision of one of the Institute's adjunct professors.

Application forms and further information may be obtained by writing to the director of the Institute.

### Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology

The Departments of Chemistry and Biology at Carleton University and the University of Ottawa, and the Department of Psychology at Carleton University, provide a collaborative program in chemical and environmental toxicology at the M.Sc. level. For further details, see p.110.

### Members of the Institute

- \* Howard Alper, *Organometallic Chemistry*
- \* A.D.O. Bawagan, *Chemical Physics*
- \* D.M. Bishop, *Theoretical Chemistry*
- \* G.W. Buchanan, *Applications of NMR Spectroscopy*
- \* P.H. Buist, *Bio-organic Chemistry*
- \* R.C. Burk, *Environmental and Analytical Chemistry*
- \* A.J. Carty, *Organometallic and Inorganic Chemistry* (Adjunct)
- \* C.L. Chakrabarti, *Analytical Chemistry, Environmental Chemistry*
- \* B.E. Conway, *Electrochemistry and Surface Chemistry*
- \* R.J. Crutchley, *Physical Inorganic Chemistry*
- \* Christian Detellier, *Bio-inorganic Chemistry*
- \* Tony Durst, *Synthetic and Medicinal Organic Chemistry*
- \* A.G. Fallis, *Synthetic Organic Chemistry*
- \* D.E. Fogg, *Organometallic, Polymer and Materials Chemistry*
- \* Sandro Gambarotta, *Inorganic Chemistry*
- \* B.R. Hollebone, *Chemical Spectroscopy and Chemical Toxicology*
- \* J.L. Holmes, *Mass Spectroscopy*
- \* K.U. Ingold, *Physical Organic Chemistry, Free Radicals* (Adjunct)
- \* Harvey Kaplan, *Biochemistry*
- \* Peeter Kruus, *Solution Physical Chemistry, Ultrasonics*
- \* E.P.C. Lai, *Photoacoustic Spectroscopy, Analytical Chemistry*
- \* Paul M. Mayer, *Gas Phase Ion Chemistry*
- \* D. Miller, *Environmental Chemistry*
- \* Mario Morin, *Electrochemistry*
- \* B.A. Morrow, *Surface Chemistry and Catalysis*
- \* R.J. Norstrom, *Environmental Chemistry* (Adjunct)
- \* D.S. Richeson, *Inorganic, Solid State and Organometallic Chemistry*
- \* J.A. Ripmeester, *Colloid and Clathrate Chemistry* (Adjunct)
- \* R. Roy, *Glycobiology, Combinational and Medicinal Chemistry*

- \* J.C. Scaiano, *Photochemistry*
- \* Alain St-Amant, *Theoretical and Computational Chemistry*
- \* S. Scott, *Surface Chemistry & Catalysis*
- \* K.B. Storey, *Enzyme Biochemistry, Biotechnology*
- \* Heshel Teitelbaum, *Chemical Kinetics*
- \* C.S. Tsai, *Enzyme Action and Yeast Cultures*
- \* Z.Y. Wang, *Synthetic Polymer Chemistry and Organic Chemistry*
- \* J.S. Wright, *Theoretical Chemistry*

## Master of Science

### Admission Requirements

The normal requirement for admission to the program is an Honours B.Sc. degree in Chemistry, with a B+ average in the last two years and a B average overall. Applicants who do not meet this requirement, or whose undergraduate degree is in another, closely related field, may be accepted into the program, but may be assigned extra courses.

### Program Requirements

- \* A research thesis defended at an oral examination
- \* Two graduate courses (one semester each)
- \* One seminar course (two semesters)

### Guidelines for Completion of Master's Degree

Full-time students in the master's program will normally complete the degree requirements in two years. Part-time students will normally complete the degree requirements in four years.

## Doctor of Philosophy

### Admission Requirements

The normal requirement for admission to the Ph.D. program is a B.Sc. or M.Sc. degree in Chemistry.

### Program Requirements (from B.Sc.)

- \* A research thesis defended before an examination board which includes an external examiner
- \* A comprehensive examination in chemistry; the format of this examination depends on the field of chemistry in which the student is conducting his/her research. At

Carleton this normally takes the form of a research proposal

- \* Four graduate courses (one semester each)
- \* Two seminar courses (two semesters each)

### Program Requirements (from M.Sc.)

Same as above, except that under exceptional circumstances only one seminar course will be required and credit for up to two graduate courses may be given to reduce the requirement for graduate courses from four to two.

### Residence Requirements

For the M.Sc. degree:

- \* At least one year of full-time study

For the Ph.D. degree (from B.Sc.):

- \* At least three years of full-time study

For the Ph.D. degree (from M.Sc.):

- \* At least two years of full-time study

### Guidelines for Completion of Doctoral Degree

Full-time students in the doctoral program will normally complete the degree requirements in three years. Part-time students will normally complete the degree requirements in six years.

Full-time students who enter the doctoral program directly from the B.Sc. program will normally complete the degree requirements in four and one-half years. Part-time students will normally complete the degree requirements in nine years.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

Chemistry 65.509 (CHM8150)

**Special Topics in Molecular Spectroscopy**  
Topics of current interest in molecular spectroscopy. In past years, the following areas have been covered: electronic spectra of diatomic and triatomic molecules and their interpretation using molecular orbital diagrams; Raman and resonance Raman spectroscopy; symmetry aspects of vibrational and electronic levels of ions and molecules in solids; the presence of weak and strong resonant laser radiation. (Also listed as Physics 75.522/PHY8122)

Chemistry 65.511 (CHM8181)

**Chemical Physics of Electron-Molecule Collisions**

Basic classical scattering theory and quantum mechanical scattering theory. Experimental aspects, such as electron optics, electron gun fundamentals, energy analyzers and electron detectors. Applications to the understanding of the chemistry of materials.

Chemistry 65.512 (CHM8172)

**Supercritical Fluids**

Fundamental and practical aspects of the uses of supercritical fluids in the chemistry laboratory. Thermodynamic treatment of high pressure multicomponent phase equilibria, transport properties, solubilities, supercritical fluid extraction and chromatography for analytical purposes, reactions in supercritical fluids, equipment considerations, new developments.

Chemistry 65.515 (CHM8171)

**Computational Chemistry**

Introduction to the theory, limitations, and applications of molecular mechanics, molecular dynamics, Monte Carlo techniques, genetic algorithms, semi-empirical molecular orbital methods, and density functional methods. Introduction to the Unix operating system, the internet, and hardware and software considerations.

Chemistry 65.516 (CHM8170)

**Quantum Chemistry**

Molecular orbital theory and its application to chemistry. Self-consistent field method, results for diatomic molecules. Configuration interaction and molecular dissociation. Basis sets and molecular properties. Ab initio versus semi-empirical approaches. Correlation diagrams for chemical reactions. Polyatomic molecules and potential energy surfaces.

Chemistry 65.517 (CHM8161)

**Physical Chemistry of Solutions**

Major theoretical approaches and experimental methods used in the study of liquids and solutions.

Prerequisite: A reasonable background knowledge in thermodynamics, quantum chemistry, and statistical mechanics.

Chemistry 65.520 (CHM8152)

**Surface Chemistry and Catalysis**

Adsorption phenomena and isotherms, surface area of solids. Modern techniques in surface chemistry and surface science such as electron diffraction, Auger electron spectroscopy, photo-electron spectroscopy, electron energy loss spectroscopy, infrared and Raman spectroscopy. Current new techniques.

Chemistry 65.522 (CHM8131)

**Physical Chemistry of Electrolytic Solutions**

Properties of water, hydration of ions, ionic interaction, colloidal and polymeric electrolytes. Ionization processes in solution.

Chemistry 65.523 (CHM8141)

**Applied Electrochemistry**

Selected topics in applied electrochemistry will be reviewed, including metal electrodeposition, organic electrochemistry, performance of batteries, electrochemical energy conversion, corrosion and passivity. Electrochemistry at semiconductors.

Chemistry 65.524 (CHM8151)

**Electrochemistry at Interfaces**

Introduction to electrode processes and electrolysis. Potential differences at interfaces. Characterization of the electrical double layer. Dipole orientation effects; charge transfer in absorbed layers; electrochemical origins of surface science concepts. Theory of electron transfer; electrode kinetics; electrocatalysis. Industrial applications; photo-electrochemistry.

Chemistry 65.527 (CHM8121)

**Organic Reaction Mechanisms**

Advanced physical organic chemistry, including topics such as: acidity functions, pKas of organic compounds, steric and electronic effects in organic chemistry, molecular orbital theory and correlation diagrams, structure calculations using molecular mechanics.

Chemistry 65.528 (CHM8133)

**Multinuclear Magnetic Resonance**

**Spectroscopy**

Principles of Nuclear Magnetic Resonance (NMR). The NMR parameters to be studied are: chemical shift, spin-spin coupling, electric quadrupole coupling, spin-spin and spin-lattice relaxation rates. NMR and the periodic table. Dynamic NMR. Applications in chemistry and biochemistry. The Fourier Transform technique. Pulse sequences. Basic principles and applications of two-dimensional NMR.

Chemistry 65.529 (CHM8154)

**Reaction Intermediates**

Introduction to the basic principles of photochemistry in condensed phases as a method for the generation of reactive intermediates. This is followed by a series of selected topics to cover various types of reaction intermediates and the techniques for their study. Topics include: excited states, free radicals, carbenes, biradicals, enols, carbocations and zwitterionic intermediates. The techniques include laser and conventional flash photolysis, pulse radiolysis, esr, CIDNP and matrix isolation. Several of these topics are covered in student seminars.



Chemistry 65.530 (CHM8159)

**Total Synthesis: Strategies and Case Studies**

General procedures for the total synthesis of natural products will be examined. A general discussion of retrosynthetic planning, choice of starting materials, multiple bond construction, stereochemical considerations and choice of strategies will be followed by the analysis of recent syntheses. Comparison of alternative solutions emanating from different laboratories will be studied as will recent trends including pericyclic reactions, free radical cyclizations, etc. A reasonable knowledge of modern organic reactions is assumed.

Chemistry 65.531 (CHM8160)

**Chiron Approach to Natural Product Syntheses**

Retrosynthetic analysis and description of natural product total synthesis through the chiron strategy with emphasis on carbohydrates and amino acids as chiral building blocks. Macrolides and polyether synthesis. Diversity in carbohydrates; chiral templates and their selective manipulations. Aspects of protecting group chemistry, stereoelectronic effects, and chirality induction and transfer.

Chemistry 65.532 (CHM8132)

**Enzymology and Protein Chemistry**

Basic principles of structure-function relationships in proteins. Chemical nature of polypeptides and the folded conformation of proteins. Enzymatic catalysis; protein engineering.

Chemistry 65.533 (CHM8126)

**Bioorganic Chemistry**

Overview of recent developments in the general area of biocatalysis. Current examples of the biotransformation of organic compounds using enzyme models, abzymes, enzymes, immobilized enzymes, microbial cells and recombinant microbial cells. Biosynthetic procedures of industrial importance in waste management.

Chemistry 65.537 (CHM8169)

**Chemistry of the Transition Metals**

Introduction. Bonding in transition metal complexes: V.B. treatment, crystal field and ligand field, Jahn-Teller effect, spectrochemical series. Nomenclature. M-M bonds between transition metals. General introduction, bonding, treatment of zerovalent clusters, treatment of medium valent clusters. Descriptive chemistry. Activation of small molecules (CO, N<sub>2</sub>, CO<sub>2</sub>, NO). Activation of H<sub>2</sub> and of C-H, agostic interactions. Theoretical background. Descriptive chemistry. Olefin activation. Theoretical background, metathesis, polymerization, isomerization, carbonylation, insertion reactions. Environmental catalysis.

Chemistry 65.538 (CHM8122)

**Solid State Chemistry**

Thermodynamic and kinetic aspects of solid state synthesis. Spectroscopic and structural characterization of solids. Chemical and physical properties of solids including intercalation reactions, ionic conductors, glasses, electronic, magnetic, optical, and physical/mechanical properties.

Precludes additional credit for Chemistry 65.545 (CHM8127) (if taken before 1996-97).

Chemistry 65.539 (CHM8144)

**Electron Transfer Reactions: Theory and Experiment**

Development of electron transfer theory from classical, semi-classical to quantum mechanical treatments. Recent experimental results related to classical Marcus electron transfer theory and the application of electron transfer theory to biological processes.

Chemistry 65.540 (CHM8114)

**Special Topics in Non-Metal Chemistry**

Topics of current interest in non-metal chemistry. The content of this course may vary from year to year.

Chemistry 65.541 (CHM8117)

**Organometallic Chemistry**

A discussion of the formation, character, bonding and reactions of compounds containing organic ligands bound to metals through from one to eight carbon atoms. Industrial processes (olefin meta-thesis, the OXO process, the Monsanto acetic process, etc.) and biological processes (e.g. reactions catalyzed by coenzyme B12) are also examined. The emphasis is on transition metal chemistry, including synthesis and mechanisms of the reactions concerned, and on the physical techniques available for characterization of the compounds.

Chemistry 65.542 (CHM8115)

**Special Topics in Inorganic Chemistry**

Topics of current interest in inorganic chemistry. In the past, the course has covered Ceramics: binary and ternary phase diagrams and their thermodynamic basis; pyrometallurgical and ceramic thermochemistry; glasses; molten salts and solid solutions; defects; doping and preparation of pure materials; electrical and surface properties of ceramics.

Chemistry 65.543 (CHM8112)

**Methods in Analytical Chemistry**

This course describes the criteria used in choosing the best analytical technique for specific problems including accuracy, precision, sensitivity, linearity, detection limits, interferences and the commercial availability of suitable instrumentation for analysis by atomic spectroscopy, electro-chemistry, chromatog-

raphy, molecular spectrometry and mass spectrometry.

Chemistry 65.544 (CHM8125)

**Organic Synthesis (Carbanion Chemistry)**

Discussion of recent developments in the use of carbanion chemistry for the making of carbon-carbon and carbon-heteroatom bonds. Particular emphasis is given to methods which yield optically active products. In the most recent course the following topics were covered: methods of generating carbanions, kinetic versus thermo-dynamic acidity, heteroatom-stabilized carbanions, the aldol and related condensations, Michael addition reactions, and ortho-metalation in aromatic systems.

Chemistry 65.545 (CHM8166)

**Advanced Carbohydrate Chemistry**

Medicinal organic chemistry related to carbohydrates. New glycosylation strategies in the design of O, C, N, S and P-glycosyle derivatives. Nucleotides and glycopeptides synthesis. Glycoconjugate synthesis and their immunochemical significance as vaccines, diagnostics and cell targeting systems. Glycopolymer preparations. Biological roles of carbohydrates.

Chemistry 65.546 (CHM8164)

**Organic Polymer Chemistry**

Introduction to basic principles of polymer chemistry, industrial and synthetic polymers, different types of polymerization and polymer characterization. This is followed by a series of selected topics to cover some important polymers with emphasis on the synthesis, such as commodity plastics, engineering thermoplastics and specialty polymers. Also offered at the undergraduate level, with different requirements, as Chemistry 65.424, for which additional credit is precluded.

Prerequisites: Chemistry 65.321 and 65.322 and/or 65.423 or the equivalent. Students should have a basic knowledge of organic reaction mechanisms and stereochemistry.

Chemistry 65.547 (CHM8134)

**Spectroscopy for Organic Chemists**

Analysis of proton NMR spectra. Fourier transform  $^{13}\text{C}$  NMR, strategies for structure elucidation relaxation times, two-dimensional NMR. Aspects of mass spectrometry. Also offered at the undergraduate level, with different requirements, as Chemistry 65.442, for which additional credit is precluded.

Chemistry 65.548 (CHM8122)

**Special Topics in Organic Chemistry**

Topics of current interest in organic chemistry. In the past, one course has covered solid state NMR: chemical aspects of solid state structure; molecular ordering and motion in the

solid state; magnetic interactions; hydrogen, deuterium and  $^{13}\text{C}$  NMR; experimental methods; applications; relationship between high resolution solid-state and solution NMR.

Chemistry 65.549 (CHM8123)

**Recent Advances in Organic Chemistry**

Topics of current interest will be discussed.

Chemistry 65.550 (CHM8116)

**Analytical Instrumentation**

Principles of modern electronic instrumentation and their application in the chemical laboratory. Scientific instruments; measurement and control systems; microcomputer interfacing. Instrumentation concepts including feedback control, signal-to-noise enhancement, data acquisition, and signal processing will be presented along with the techniques and devices for their implementation. A parallel laboratory is taught using modern test instruments. Examples include absorption spectrophotometer, derivative titration thermocouple, pH meter, and cyclic voltammetry.

Chemistry 65.551 (CHM8220)

**Problems in Organic Chemistry**

The problems which are assigned in this course are of two types: (1) written examinations on a particular topic in organic chemistry, (2) critical reviews of papers in the current organic literature, i.e. a simulated referee's report on the paper. In order to pass the course, eight problems must be solved satisfactorily.

Chemistry 65.552 (CHM8110)

**Analytical Approach to Chemical Problems**

Case-study approach to a variety of problems in agricultural, biochemical, environmental, food processing, geological, industrial and surface sciences that can be solved by analytical chemistry. Comparative study of analytical methods appropriate to each case includes: capillary electrophoresis, chemiluminescence, electrochemical biosensors, Fourier transform infrared spectroscopy, inductively coupled plasma emission, neutron activation analysis, sensor arrays, secondary ion mass spectrometry, tandem mass spectrometry, and ultra-high resolution nuclear magnetic resonance spectroscopy. Modern data analysis techniques such as pattern recognition are also discussed.

Chemistry 65.553 (CHM8108)

**Analytical Mass Spectrometry**

The course consists of four sections: the basics of mass spectrometry and gas phase ion chemistry; the instrumentation currently available and the principles of its operation, methods of ionization; separation techniques, their successes and limitations when connected to a mass spectrometer; and the obtaining and

interpretation of data. The relationships between mass spectra and chemical structure are also examined.

Chemistry 65.555 (CHM8119)

**Advanced Ultratrace Analytical Chemistry.** Criteria for evaluation and selection of analytical techniques and methods. Simultaneous and sequential multielement analysis. Atomic absorption, atomic emission and atomic fluorescence spectrometry, using optical spectrometric and mass-spectrometric determination. Electroanalytical techniques. Applications of these techniques at trace and ultratrace levels in complex matrices.

Chemistry 65.556 (CHM8120)

**Environmental Analytical Chemistry of Inorganic Systems**

Sampling of the atmospheric and the aquatic environment. The problems of sampling artifacts and of blanks in the sub-parts-per-trillion concentration levels. Analytical techniques and methods for quantitative determination of analytes in elemental and isotopic form. Analytes in molecular form and analytical techniques for chemical speciation. Advantages and limitations of various speciation schemes.

Chemistry 65.557 (CHM8162)

**Environmental Organic Chemistry**

Methods for determination of organic analytes in environmental systems. All aspects of a method will be discussed, including sampling, sample treatment, measurement, quality control, and data significance. Application to such environmentally important analytes as PCGs, dioxins, pesticides, herbicides, trihalomethanes, and polycyclic aromatic hydrocarbons. Rationale and selection of specific methods.

Chemistry 65.558 (CHM8163)

**Special Topics in Analytical Chemistry**

Topics of current interest in analytical chemistry. The content of this course may change from year to year.

Chemistry 65.570 (CHM8143)

**Special Topics in Physical Chemistry**

Topics of current interest in physical chemistry. The content of this course may change from year to year.

Chemistry 65.571 (CHM8145)

**Photochemistry**

Photochemical reactions of small molecules and the relation to atmospheric chemistry. Lasers and applications to measurements of the dynamics of elementary reactions. Production and detection of reactive species. Energy transfer processes. Photolysis of formaldehyde and carbonyl compounds. Multiphoton absorption of infrared radiation.

Chemistry 65.572 (CHM8135)

**Theories of Chemical Reaction Rates**

Concepts and theories of chemical kinetics. Significance of activation energy; transition state theory and more modern developments; reaction dynamics. Other optional topics include unimolecular gas reactions, theory of solvent effects, homogeneous and heterogeneous catalysis, and kinetic isotope effects.

Chemistry 65.573 (CHM8137)

**Advanced Chemical Kinetics**

Study of the principles involving the exchange of translational, rotational, vibrational and electronic energy in molecular collisions. Influence of energy transfer processes on thermal unimolecular and biomolecular reactions. Study of the relationship between microscopic and macroscopic kinetics of elementary reactions.

Chemistry 65.574 (CHM8142)

**Symmetry in Chemistry**

Introduction to group theory with emphasis upon irreducible representations. Application to molecular vibrations, molecular orbital theory and transition metal chemistry.

Chemistry 65.576 (CHM8148)

**Gas Phase Ion Chemistry**

Structure, energetics and reaction kinetics of ions in the gas phase. Small organic ions, chemistry of free radicals, hypervalent species. Contemporary experimental methods in the physical chemistry of fast ion beams. Emphasis will also be upon recent work on novel ions and neutral species of relevance to interstellar chemistry.

Chemistry 65.577 (CHM8138)

**Enzyme Kinetics and Mechanism**

Kinetic studies of enzymic reactions. Enzyme efficiency, specificity and versatility. Mechanisms and regulation of enzymic reactions. Analyses of enzymic systems.

Chemistry 65.578 (CHM8156)

**Principles of Toxicology**

This course identifies the basic theorems of toxicology with examples of current research problems. Toxic risk is defined as the product of intensive hazard and research problems. Each factor is assessed in scientific and social contexts and illustrated with many types of experimental material. (Also listed as Biology 61.642(BIO9101))

Chemistry 65.579 (CHM8157)

**Chemical Toxicology**

An introduction to modeling chemical hazards and exposures at the cellular level. The properties of toxic substances are compared to the responses of enzymatic systems. These interactions are defined as Quantitative Struc-



ture-Activity Relationships and used to interpret hazardous materials under regulations such as WHMIS. (Also listed as Biology 61.579(BIO8113))

Prerequisite: Biology 61.642/Chemistry 65.578 (BIO9101/CHM8156).

Chemistry 65.581 (CHM8256S)

**Seminar I**

Chemistry 65.582 (CHM8257S)

**Seminar II**

Chemistry 65.585 (CHM8167)

**Seminar in Toxicology**

This course introduces the seminar format and involves student, faculty and invited seminar speakers. The student will present a seminar and submit a report on a current topic in toxicology. (Also listed as Biology 61.645)

Chemistry 65.590 (CHM8158)

**Directed Special Studies**

Under unusual circumstances and with the recommendation of the research supervisor, it is possible to engage in directed study on a topic of particular value to the student. This may also be used for credit if there are insufficient course offerings in a particular field of chemistry.

Chemistry 65.599 (CHM7999)

**M.Sc. Thesis**

Chemistry 65.699 (CHM9999)

**Ph.D. Thesis**

## Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology

Room 2240 Herzberg Building  
Telephone: 520-3515  
Fax: 520-2569

### The Program

**Coordinator of the Collaborative Program,** D. Lean, Department of Biology, University of Ottawa

**Associate Coordinator of the Collaborative Program,** B.R. Hollebhone, Department of Chemistry, Carleton University

Toxicology is the study of the effects of poisons on living systems. These poisons can be either inorganic, synthetic, or natural organic materials. As a field of research, toxicology cuts across traditional disciplinary boundaries such as chemistry, biology. While individual researchers usually specialize in a particular area, toxicologists today must be able to appreciate significant research in other fields and therefore require an understanding of the basic principles of other disciplines. To meet this challenge, Carleton University and the University of Ottawa offer a multidisciplinary Collaborative Program in Chemical and Environmental Toxicology as a Specialization in Toxicology of the Master of Science degree offered in the two joint Institutes: The Ottawa-Carleton Institute of Biology, which consists of the Departments of Biology at Carleton University and the University of Ottawa; The Ottawa-Carleton Chemistry Institute, which consists of the Departments of Chemistry at Carleton University and the University of Ottawa.

The Collaborative Program is coordinated by a committee of representatives of these participating units. The Program is intended to focus the research and training which the student receives through either of these Institutes onto the specific, interdisciplinary problems of toxicology. The student is responsible for fulfilling the requirements of both the Master of Science degree in the chosen Institute and the additional requirements of the Collaborative Program. The Master of Science degree awarded will specify the discipline of the Institute, with the additional notation of the Specialization in Chemical and Environmental Toxicology.

To enter the Program, students would first apply directly to the Institute which is most appropriate to their research interests. Once accepted into this chosen Institute, students may then apply to the Collaborative Program

to undertake relevant course work and research for the Specialization in Toxicology. Further information can be obtained from the Coordinator or Associate Coordinator or the Directors or Associate Directors of the Biology or Chemistry Institutes.

### List of Coordinators and Members of the Collaborative Program in Chemical and Environmental Toxicology

**Coordinator of the Collaborative Program,** D. Lean, Department of Biology, University of Ottawa

**Associate Coordinator of the Collaborative Program,** B.R. Hollebhone, Department of Chemistry, Carleton University

### Members of the Collaborative Program;

- \* Amason, J.T., Ph.D., *Plant secondary chemicals, plant-insect interactions*, Ottawa-Carleton Institute of Biology, University of Ottawa.
- \* Bawagan, A.D.O., Ph.D., *Physical Chemistry*, Ottawa-Carleton Chemistry Institute, Carleton University.
- \* Burk, R., Ph.D., *Environmental Analytical Chemistry*, Ottawa-Carleton Chemistry Institute, Carleton University.
- \* Chakrabarti, C.L., Ph.D., D.Sc., *Environmental Toxicology*, Ottawa-Carleton Chemistry Institute, Carleton University (Adjunct).
- \* Charest, C., Ph.D., *Plant Eco-Physiology*, Ottawa-Carleton Institute of Biology, University of Ottawa.
- \* Findlay, C.S., Ph.D., *Modeling of toxicant transport*, Ottawa-Carleton Institute of Biology, University of Ottawa.
- \* Gardner, D.R., Ph.D., *Pesticide-nerve interactions*, Ottawa-Carleton Institute of Biology, Carleton University.
- \* Hollebhone, B.R., Ph.D., *Chemical Toxicology*, Ottawa-Carleton Chemistry Institute, Carleton University.
- \* Kennedy, S.W., Ph.D., *Environmental Toxicology*, Ottawa-Carleton Institute of Biology, University of Ottawa. (Adjunct)
- \* Lai, E.P.C., Ph.D., *Analytical Chemistry*, Ottawa-Carleton Chemistry Institute, Carleton University.

- \* Lambert, I.B., Ph.D., *Genetic Toxicology, Biochemistry*, Ottawa-Carleton Institute of Biology, Carleton University.
- \* Lean, D.R.S., Ph.D., *NSERC Industrial Chair in Ecotoxicology*, Ottawa-Carleton Institute of Biology, University of Ottawa.
- \* Miller, J.D., Ph.D., *Environmental Toxicology of Natural Toxins*, Ottawa-Carleton Chemistry Institute, Carleton University.
- \* Mineau, P., Ph.D., Adjunct Professor, *Wild life and Pesticide Toxicology*, Ottawa-Carleton Institute of Biology, Carleton University.
- \* Mitchel, R.E.J., Ph.D., *Radiation Toxicology*, Ottawa-Carleton Institute of Biology, University of Ottawa. (Adjunct)
- \* Moon, T.W., Ph.D., *Comparative Physiology, Biochemistry*, Ottawa-Carleton Institute of Biology, University of Ottawa.
- \* Philogene, B.J.R., Ph.D., *Insect Physiology, Chemical Ecology*, Ottawa-Carleton Institute of Biology, University of Ottawa.
- \* Pick, F.R., Ph.D., *Aquatic Sciences, Microbial Ecology*, Ottawa-Carleton Institute of Biology, University of Ottawa.
- \* Scaiano, J.C., Ph.D., *Physical Organic Chemistry, Photochemistry*, Ottawa-Carleton Chemistry Institute, University of Ottawa.
- \* Scott, S.L., Ph.D., *Surface Chemistry, Kinetics*, Ottawa-Carleton Chemistry Institute, University of Ottawa.
- \* Trudeau, V.L., Ph.D., *Physiology and Toxicology of Reproduction*, Ottawa-Carleton Institute of Biology, University of Ottawa.
- \* Wigfield, D.C., Ph.D., *Chemical Toxicology*, Ottawa-Carleton Chemistry Institute, Carleton University.
- \* Wyndham, R.C., Ph.D., *Molecular Microbial Ecology*, Ottawa-Carleton Institute of Biology, Carleton University.

## Master's Program

### Admission Requirements

Admission to the Collaborative Program in Chemical and Environmental Toxicology, leading to the Specialization in Toxicology of the Master of Science in Biology or Chemistry is considered after the student has been admitted to the Master of Science program of one of the participating Institutes. Acceptance is normally based on:

\*A high honours GPA in the undergraduate degree or in graduate course work.

\*A letter of recommendation from a faculty member participating in the Collaborative Program, which both recommends admission and indicates the willingness of the faculty member to supervise and sponsor the candidate's research program in a relevant field of chemical and /or environmental toxicology.

### Program Requirements

Students must fulfill the Master of Science degree requirements for the Institute in which they are enrolled. To qualify for the additional Specialization of the degree, the following specific courses are required:

\*Biology 61.642/Chemistry 65.578 (BIO 9101/CHM 8156) (0.5 credit)

\*Biology 61.645/Chemistry 65.585 (BIO 9105/CHM 8167) (0.5 credit)

\*One additional Toxicology course (0.5 credit) chosen from;

\*Biology 61.643 (BIO 9104)

\*Chemistry 65.579 (CHM 8157)

\*One course approved by the Coordinator or Associate Coordinator (0.5 credit)

Other courses offered in the programs of the primary Institutes may be taken as options, with the permission of the student's supervisory committee, in addition to these basic requirements of the Collaborative program in Chemical and Environmental Toxicology. As necessary, the Institute may also direct the student to take or audit additional courses to complement background knowledge.

The student is also required to present a research thesis on a topic in a relevant aspect of chemical or environmental toxicology. This relevance must be identified clearly in the written thesis.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

Other courses listed in the calendar under the primary academic units of psychology, biology, or chemistry may be taken, with the



approval of the student's supervisory committee, as options in addition to the basic requirements of the degree in chemical and environmental toxicology.

Course numbers refer to Carleton University (University of Ottawa) listings of the Institutes.

Biology 61.642/Chemistry 65.578(BIO9101/CHM8156)

### **Principles of Toxicology**

This course identifies the basic theorems of toxicology with examples of current research problems. Toxic risk is defined as the product of intensive hazard and extensive exposure. Each factor is assessed in scientific and social contexts and illustrated with many types of experimental material.

Biology 61.643/Chemistry 65.575(BIO9104/CHM9109)

### **Ecotoxicology**

Concepts of ecotoxicology, emphasizing whole ecosystem response to hazardous contaminants. The focus is the impacts of chronic and acute exposure of ecosystems to toxicants, the methods of pesticide, herbicide and pollutant residue analysis and the concept of bound residues.

Prerequisite: Biology 61.642/Chemistry 65.578 ((BIO9101/CHM8156)

Biology 61.645/Chemistry 65.585(BIO9105/CHM8167)

### **Seminar in Toxicology**

This course introduces the seminar format and involves student, faculty and invited seminar speakers. The student will present a seminar and submit a report on a current topic in toxicology.

Biology 61.579/Chemistry 65.579(BIO8113/CHM8157)

### **Chemical Toxicology**

An introduction to modeling chemical hazards and exposures at the cellular level. The properties of toxic substances are compared to the responses of enzymatic systems. These interactions are defined as Quantitative Structure-Activity Relationships and used to interpret hazardous materials under regulations such as WHMIS.

Prerequisite: Biology 61.642/Chemistry 65.578(BIO9101/CHM8156).

Chemistry 65.543 (CHM8112)

### **Methods of Analytical Chemistry**

This course describes the criteria used in choosing the best analytical technique for specific problems including, accuracy, precision, sensitivity, linearity, detection limits, interferences and the commercial availability of suitable instrumentation for analysis by atomic spectroscopy, electro-chemistry, chromatography, molecular spectrometry and mass spectrometry.

# Ottawa-Carleton Institute for Civil Engineering

Mackenzie Building 3432  
Telephone: 520-5784  
Fax: 520-3951

Université d'Ottawa  
University of Ottawa



Carleton University

## The Institute

**Director of the Institute, Hiroshi Tanaka**

**Associate Director of the Institute, D.T. Lau**

Established in 1984, the Institute combines the research strengths and resources of the Departments of Civil and Environmental Engineering at Carleton University and the Department of Civil Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the Institute in a wide range of fields of civil engineering. Programs in water resources engineering, and in transportation engineering are centred at the University of Ottawa and Carleton University, respectively. Programs in environmental, geotechnical, and structural engineering are available at both universities. Graduate students may pursue their research on either university campus, depending upon the choice of program and supervisor. Registration will be at the university to which the student's supervisor is affiliated. Requests for admission may be sent to the Director of the Institute.

## Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Civil and Environmental Engineering at Carleton University and (O) for the Department of Civil Engineering at the University of Ottawa.

- \* A.O. Abd El Halim, Transportation, Pavements and Materials, Geometric Design (C)
- \* Kazimierz Adamowski, Hydrology, Stochastic and Statistical Analyses (O)
- \* J. Adjeleian, Structures, Building Design & Construction (C - Professor Emeritus)]
- \* M.O. Al-Hunaidi, Soil Dynamics, Soil Structure Interaction, Non Destructive Testing (O) - Adjunct)
- \* A. Baskaran, Building Science, Computational Fluid Dynamics (O - Adjunct)
- \* G.E. Bauer, Geotechnical Engineering, Earth Retaining Structures, In-Situ Testing (C)
- \* J.J. Beaudoin, Cement Chemistry, Strength of Composite Materials (O - Adjunct)
- \* D.W.R. Bell, Transportation, Engineering

Economics and Policy, Airport Planning (C - Adjunct)

- \* J.P. Braaksma, Transportation, Airport Planning, Traffic Engineering, Pedestrian Circulation, Terminal Design (C)
- \* M. Bruneau, Steel Structures, Earthquake Engineering, Computer Aided Design (O)
- \* M.S. Cheung, Finite Element Analysis, Bridge Engineering (C - Adjunct)
- \* S.E. Chidiac, Heritage Structures, Durability, Mathematical Modelling (C - Adjunct)
- \* R.L. Droste, Environmental Engineering, Water and Wastewater Treatment (O)
- \* S.M. Easa, Highway Geometry, Reliability Concept, Planning (C - Adjunct)
- \* Erman Evgin, Finite Elements, Soil Plasticity, Environmental Geomechanics (O)
- \* G.Y. Felio, Performance and Rehabilitation of Urban Infrastructure, Water Distribution System (C - Adjunct)
- \* B.N. Fellenius, Geotechnical Engineering, Deep Foundations (O - Adjunct)
- \* Leta Fernandes, Environmental Engineering, Agricultural Waste Management (O)
- \* N.J. Gardner, Structures, Reinforced Concrete, Earthquake Engineering, Construction Loads (O)
- \* V.K. Garga, Geotechnical Engineering, Dams, Harbours, Heavy Foundations (O)
- \* G.A. Hartley, Structural Analysis, Finite Elements, Building Frame Analysis (C)
- \* N.M. Holtz, Computer-Aided Structural Engineering (C)
- \* J.L. Humar, Structures, Earthquake Engineering, Computer-Aided Design (C)
- \* K. Ibrahim, Structural Engineering, Masonry Structures (C - Adjunct)
- \* W.F. Johnson, Urban Transportation Planning and Management (C - Adjunct)
- \* Deniz Karman, Environmental Engineering, Air Pollution and Control (C)
- \* K.J. Kennedy, Environmental Engineering, Waste Water Treatment (O - Adjunct)
- \* S.J. Kennedy, Steel Structures, Composite Structures, Material Behaviour, Experimental Methods, Computer-Aided Structural Engineering (C)
- \* A.M. Khan, Transportation, Systems Planning, Engineering and Management (C)

- \* D.T. Lau, Earthquake Engineering, Numerical Methods and Modelling of Structures, Monitoring of Structures (C)
- \* K.T. Law, Geotechnical Engineering, Embankments, In-Situ Testing (C)
- \* J.R. Mehafeey, Fire Protection Engineering (C - Adjunct)
- \* E.H. Mohamed, Transportation Engineering, Pavement & Materials (C - Adjunct)
- \* R.M. Narbaitz, Waste Treatment (O)
- \* Simon Ng, Structures, Numerical Methods, Dynamic Behaviour (O)
- \* W.J. Parker, Environmental Engineering, Waste Water Treatment, Hazardous Waste Management, Solid Waste Management (C)
- \* G.G. Patry, Wastewater Treatment Process Simulation and Control (O)
- \* B.N. Persaud, Transportation, Traffic Engineering, Highway Safety (C - Adjunct)
- \* A.G. Razaqpur, Structures, Concrete, Numerical Methods (C)
- \* Murat Saatcioglu, Building Structures, Reinforced Concrete, Earthquake Analysis and Design (O)
- \* J.J. Salinas, Building Structures, Wood Engineering, Structural Reliability (C)
- \* E.J. Schiller, Environmental Engineering, Water Supply and Irrigation (O)
- \* A.P.S. Selvadurai, Geotechnical Engineering, Continuum Mechanics, Applied Mathematics (C - Adjunct)
- \* L.A.Y. Shallal, Transportation, Planning and Management, Traffic Engineering (C - Adjunct)
- \* Sampat Sridhar, Environmental Impact Assessment, Wastewater Treatment, Hazardous and Radioactive Waste, Pollution Control (C)
- \* G.T. Suter, Structural Engineering, Masonry Structures (C)
- \* O.J. Svec, Geomechanics, Pavement Materials, Numerical Methods (C - Adjunct)
- \* Hiroshi Tanaka, Structures, Wind Engineering (O)
- \* D.R. Townsend, Water Resource Engineering, Applied Hydraulics, River Engineering (O)
- \* M.A. Warith, Environmental Engineering (C/O - Adjunct)
- \* Paul Van Geel, Environmental Engineering, Groundwater Flow and Contaminant Trans-

port, Waste Disposal (C)

- \* E.W. Wright, Structures, Computer-Aided Design (C - Adjunct)

## **Master's Degree**

### **Admission Requirements**

1. Graduates from engineering or Honours science programs with a mathematics content equivalent to the civil engineering program will have to take a minimum of four qualifying undergraduate civil engineering courses in their area of graduate specialty

2. Graduates from other science programs will have to take all the core engineering undergraduate mathematics courses in addition to the requirements specified in (1) above.

The undergraduate courses required will be specified in the Certificate of Admission.

Undergraduate civil engineering courses will not be accepted towards a graduate degree. Graduate students may still be required to take undergraduate courses for credit to fulfil the admission requirements.

No more than one half of the program credit requirements or that stipulated in the regulations of the university in which the student is registered, whichever is less, can be transferred at admission. At least one half of the course work must be taken at the Institute.

### **Program Requirements**

The requirements for course work are specified in terms of credits: one credit is one hour of instruction per week for one term. The requirements for the master's degree by thesis are:

- \* Eighteen course credits
- \* Thesis equivalent to eighteen course credits
- \* Participation in the civil engineering seminar series
- \* Successful oral defence of the thesis

The requirements for the master's degree by course work are:

- \* Twenty-seven course credits
- \* A project equivalent to nine course credits

## **Doctor of Philosophy**

### **Admission Requirements**

The normal requirement for admission into the Ph.D. program is a master's degree with thesis in civil engineering.



## Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term.

- \* A minimum of fifteen course credits
- \* Participation in the civil engineering seminar series
- \* Successful completion of written and oral comprehensive examinations in subject areas determined by the student's advisory committee
- \* Successful completion of a thesis proposal examination
- \* Thesis
  - \* Successful oral defence of the thesis. The examination board for all theses will include an external examiner, and, when possible, professors from both departments.

\* Subject to approval of his/her advisory committee, a Ph.D. student may take, or be required to take, courses in other disciplines.

Students who have been permitted to transfer into the Ph.D. program from a master's program without having completed the master's degree, will require thirty course credits for the Ph.D. degree which include transfer of credits from the incompleted master's program.

## Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or the advisory committee. Graduate courses are listed below, grouped by subject area. Course descriptions may be found in the departmental section of the calendar concerned. All courses are of one term duration. The codes given in parenthesis are those used by the University of Ottawa. Courses beginning with "82" are offered at Carleton University and those beginning with "83" are offered at the University of Ottawa. Not all courses listed are necessarily given during one academic year.

### *Geotechnical and Soils*

- 82.529 (CVG7100)
- 82.530 (CVG7101)
- 82.550 (CVG7104)
- 82.551 (CVG7105)
- 82.552 (CVG7106)
- 82.553 (CVG7107)
- 82.554 (CVG7108)

- 82.580 (CVG7309), 82.584 (CVG7305)
- (CVG5100) 83.500 Deep Foundations
- (CVG5103) 83.503 Dam Engineering
- (CVG5106) 83.506 Site Improvements
- (CVG5108) 83.508 Pile Dynamics
- (CVG5171) 83.512 Strength and Deformation Behaviour of Soil and Rock
- (CVG5174) 83.514 Soil Plasticity
- (CVG5177) 83.517 Offshore Geotechnique
- (CVG5178) 83.518 Ice Mechanics

### *Structural Engineering*

- 82.511 (CVG7120)
- 82.512 (CVG7121)
- 82.513 (CVG7122)
- 82.514 (CVG7123)
- 82.515 (CVG7124)
- 82.516 (CVG7137)
- 82.520 (CVG7138)
- 82.523 (CVG7125)
- 82.524 (CVG7126)
- 82.525 (CVG7127)
- 82.526 (CVG7128)
- 82.528 (CVG7130)
- 82.560 (CVG7131)
- 82.561 (CVG7140)
- 82.562 (CVG7141)
- 82.565 (CVG7143)
- 82.566 (CVG7144)
- 82.567 (CVG7145)
- 82.568 (CVG7146)
- 82.575 (CVG7304), 82.579 (CVG7300)
- (CVG5142) 83.521 Advanced Structural Dynamics
- (CVG5143) 83.522 Advanced Structural Steel Design
- (CVG5144) 83.530 Advanced Reinforced Concrete Design
- (CVG5145) 83.523 Theory of Elasticity
- CVG5146) 83.532 Numerical Methods of Structural Analysis

(CVG5147) 83.524	Theory of Plates and Shells	(CVG5131) 83.566	River Engineering
(CVG5148) 83.535	Prestressed Concrete Design	(CVG5135) 83.568	Water Supply and Sanitation in Developing Countries
(CVG5150) 83.526	Advanced Concrete Technology	(CVG5140) 83.567	Irrigation and Drainage
(CVG5153) 83.529	Wind Engineering	<i>Environmental</i>	
(CVG5155) 83.536	Earthquake Engineering	82.570 (CVG 7160)	
(CVG5156) 83.531	Finite Element Methods I	82.571 (CVG 7161)	
(CVG5157) 83.533	Finite Element Methods II	82.572 (CVG 7162)	
(CVG5158) 83.537	Elements of Bridge Engineering	82.573 (CVG 7163)	
(CVG5154) 83.538	Random Vibrations	82.574 (CVG 7164)	
(CVG5159) 83.539	Long Span Structures	(CVG5130) 83.590	Wastewater Treatment Process
<i>Transportation</i>		<i>Design</i>	
82.533 (CVG7103)		(CVG5132) 83.591	Unit Operations of Water Treatment
82.534 (CVG7150)		(CVG5133) 83.596	Solid Waste Disposal
82.535 (CVG7151)		(CVG5134) 83.597	Chemical Analysis for Environmental Engineering
82.536 (CVG7152)		(CVG5136) 83.594	Water and Wastewater Treatment Laboratories
82.537 (CVG7153)		(CVG5137) 83.595	Water and Wastewater Treatment Process Analysis
82.538 (CVT7154)		(CVG5139) 83.593	Environmental Assessment of Civil Engineering Projects
82.539 (CVG7155)		(CVG5179) 83.598	Aerobic Digestion
82.541 (CVG7156)		(CVG5180) 83.599	Biological Nutrient Removal
82.542 (CVG7159)			
82.543 (CVG7158)			
82.585(CVG7310) - 82.589(CVG7314)			
<i>Water Resources</i>		<i>Directed Studies</i>	
(CVG5111) 83.551	Hydraulic Structures	82.596 and 82.597	
(CVG5119) 83.583	Computational Hydraulics	83.570 (CVG6108) and 83.571 (CVG6109)	Individual Directed Studies
(CVG5120) 83.556	Water Resources Systems	83.600 (CVG6399) - 83.603 (CVG6300)	Advanced Topics
(CVG5122) 83.558	Groundwater and Seepage	<i>Projects and Theses</i>	
(CVG5123) 83.559	Advanced Topics in Hydrology	82.590	
(CVG5125) 83.561	Statistical Methods in Hydrology	82.599	
(CVG5126) 83.562	Stochastic Hydrology	82.699	
(CVG5127) 83.563	Hydrologic Systems Analysis	CVG6000	Civil Engineering Report/Rapport en génie civil
(CVG5128) 83.564	Water Resources Planning and Policy	CVG7999	M.A.Sc.Thesis/Thèse
		CVG9998	Comprehensive Examination (Ph.D.) Examen de synthèse

# Civil and Environmental Engineering

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## The Department

Chair of the Department, J.L. Humar

Departmental Supervisor of Graduate Studies, D.T. Lau

In addition to University and Graduate Faculty regulations, all Engineering departments share common procedures that are described in Section 18 of the General Regulations (see p. 66.)

The Department of Civil and Environmental Engineering offers programs of study and research leading to the Master of Engineering and Ph.D. degrees in Civil Engineering. These degrees are offered through the Ottawa-Carleton Institute for Civil Engineering which is jointly administered by the Department of Civil and Environmental Engineering at Carleton University, and the Department of Civil Engineering at the University of Ottawa. For further information, including admission and program requirements, see p. 113.

The Department conducts research and has developed graduate programs in the following areas:

### \* *Environmental Engineering*

The program in environmental engineering offers opportunities for research topics in the areas of air pollution, groundwater and soil pollution, water and wastewater treatment, and solid, hazardous and radioactive waste management. The program is intended to be complementary to that at the University of Ottawa, and courses can be selected from either department.

### \* *Geotechnical Engineering*

The graduate program in geotechnical engineering places an emphasis on both theoretical and applied problems related to soil and rock mechanics and foundation engineering. These generally include the study of mechanical properties of soil and rock materials, stability of natural slopes and earth embankments, soil-foundation-structure interaction, and problems in foundation design and geomechanics. Broader programs in geotechnical engineering may be arranged by making use of courses offered in the Department of Geography at Carleton University and in the Department of Civil Engineering at the University of Ottawa.

Graduate research in geotechnical engineering is primarily directed towards the following areas:

### *Soil-Foundation Interaction*

Elastic and consolidation effects of soil-foundation interaction; soil-frame interaction; contact stress measurement; performance of rigid and flexible foundations; buried pipelines.

### *Earth Retaining Structures*

Experimental and analytical studies of anchored and braced excavations, flexible and rigid retaining walls, soil reinforcement, tunnels and conduits, field behaviour.

### *Bearing Capacity and Settlement*

Problems related to design of bridge abutments and footings located on sloped granular fill, experimental and field studies.

### *In-Situ Testing of Soils*

The use of devices such as the pressuremeter, the screw plate test, the borehole shear device, and borehole dilatometer in the assessment of geotechnical properties of soils.

### *Mechanical Behaviour*

Development of constitutive relations for soils and rock masses with yield and creep characteristics; applications to foundation engineering.

### *Mechanics of Geological Structures*

Large strain phenomena; buckling of strata; applications to underground storage structures; hydraulic fracture of oil-and gas-bearing geological media.

### *Performance of Anchors*

Theoretical and experimental analysis of deep and shallow anchors in soil, rock and concrete; group action; creep effects; prestress loss.

### *Nuclear Waste Disposal*

Theoretical modelling of rockmass-buffer-canister interaction during moisture migration; non-homogeneous swelling of buffer materials; swelling pressures in buffer systems; coupled heat and moisture flow in materials.

### \* *Structural Engineering*

The graduate program in structural engineering embodies a broad spectrum of topics involving material behaviour, structural mechanics and analysis, and the behaviour and design of buildings, bridges, and other types of structures, including liquid storage tanks, dams, and buried pipe systems, etc. These topics are in the following fields: computer applications in structural analysis; structural dynamics, seis-



mic analysis, earthquake engineering; finite element analysis; structural systems and design optimization; behaviour and design of steel, concrete, composite, timber and masonry structures; integrated treatment of structural, mechanical and electrical building requirements; construction economics; project planning; and bridge engineering. Graduate research in structural engineering is primarily directed towards the following areas:

### *Computer Applications in Structural Design*

Development of knowledge-based systems for the analysis, design, detailing, fabrication, and erection of buildings and bridges. Includes graphic interfaces, pre- and post-processing of frame analysis, load determination, and finite element analysis packages.

### *Seismic Analysis and Design*

Seismic response of set-back and other irregular buildings; computer analyses of linear and non-linear structural response; design of buildings for seismic forces; seismic behaviour of liquid storage tanks and dams; fluid structure interaction problems.

### *Monitoring and Evaluation of Structures*

Behaviour and performance of bridges, buildings, and other structures; field and laboratory monitoring techniques; instrumentation; data processing and interpretation.

### *Continuum Mechanics*

Linear and non-linear problems in elasticity; analysis of contact problems in elasticity, plasticity, and viscoelasticity; mechanics of composite materials; fracture processes in geological materials; finite deformations of rubber-like materials; poro-elasticity and micromechanics.

### *Numerical Modelling of Buildings and Bridges*

Advanced analytical modelling of reinforced and prestressed concrete, steel, and composite concrete-steel buildings and bridges. Material and geometric non-linearities, bond-slip, the advent and propagation of cracks, tension-stiffening, and shear-connectors behaviour are modelled to predict the full response of structures up to failure.

### *Behaviour and Design of Steel, Concrete and Composite Structures*

Analytical and experimental studies of structural members, substructures, and connections for buildings, bridges, and offshore structures. Development of the corresponding limit states design format design rules.

### *Masonry Behaviour and Design*

Study of strength and serviceability issues by means of theoretical approaches, testing, and field work.

### *Timber Structures*

Analysis, design, and performance evaluation of wood-structured systems and components; structural reliability.

### *\* Transportation Planning and Technology*

The graduate program in transportation planning and technology deals with problems of policy, planning, economics, design, and operations in all modes of transportation. In the area of transportation planning, the focus is on the design of transport systems, including terminals, modelling and simulation, urban and regional studies, traffic engineering, and geometric design. In the transportation technology area, programs deal with technology of vehicles and facilities, acoustics and noise, materials and pavement design. Graduate research in transportation is currently focused on the following areas:

### *Transport Policy*

Assessment and impact analysis of national, regional, and urban transportation policies.

### *Planning and Design Methodology*

Development and application of models for optimization of transport supply; transportation system management.

### *Travel and Traffic Analysis*

Behavioural theories of passenger travel, goods movement; empirical traffic studies.

### *Transportation Terminals*

Airport planning, air terminal design; bus, rail, subway terminal design, layout methods, pedestrian traffic.

### *Transportation Technology Development and Assessment*

Modernization of passenger and freight rail services; soil properties; pavement design, multi-layered systems, low temperature cracking of pavements, thermo-mechanical modelling of fracture processes in pavements; highway design, energy.

## **Departmental Facilities**

The structures laboratory facility includes an 11 m x 27 m strong floor with a clear height of 11 m; a strong pit, measuring 3 m x 3.7 m x 6.6 m for geotechnical and highway material testing; a 400,000 lb. universal testing machine with auxiliary equipment for load and displacement control; numerous hydraulic actuators; test frames; specialized equipment for torsion and impact studies; and a wide selection of measurement devices (strain gauges, LVDTs, pressure transducers, load cells, thermocouples) and several data acquisition systems for testing structural materials and components. The concrete laboratory has facilities for the casting, curing, and testing of rein-

forced concrete members. Laboratory facilities in geotechnical engineering include both large scale and conventional tri-axial testing, consolidation testing, pore water pressure measurements, and model studies of contact stress measurements. The soil dynamics and highway materials laboratories provide facilities for studies of the physical properties of soil, stabilized soil, aggregate and bituminous mixtures.

The environmental engineering laboratories comprise a total space of 170 square meters with excellent facilities for bench scale chemical and biochemical experiments. Analytical equipment and sensors are available for air, water and soil sample testing and analyses. A laboratory specially equipped with four fume hoods is available for conducting research involving volatile and hazardous substances.

Computer-related equipment with the department comprises of networks of SUN workstations, PC-based workstations and related peripherals. The computing centre of the University provides access to additional computing resources such as mainframe computers and multi-processor SUN workstations. A library of computer programs in structural, geotechnical, and transportation engineering provides a significant resource for advanced study and research.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

All courses listed are one-term courses and may be offered in either fall or winter with the exception of projects and theses.

Engineering 82.511 (CVG7120)

### Introductory Elasticity

Stresses and strains in a continuum; transformations, invariants; equations of motion; constitutive relations, generalized Hooke's Law, bounds for elastic constants: strain energy, superposition, uniqueness; formulation of plane stress and plane strain problems in rectangular Cartesian and curvilinear coordinates, Airy-Mitchell stress functions and Fourier solutions, application of classical solutions to problems of engineering interest.

Engineering 82.512 (CVG7121)

### Advanced Elasticity

Continuation of topics introduced in Engineering 82.511. Complex variable solutions: torsional and thermal stresses; axially symmet-

ric three-dimensional problems, Love's strain potential, Boussinesq-Galerkin stress functions; problems related to infinite and semi-infinite domains. Introduction to numerical methods of stress analysis, comparison of solutions. Prerequisite: Engineering 82.511 or permission of the Department.

Engineering 82.513 (CVG7122)

### Finite Element Methods in Stress Analysis

Stress-strain and strain-displacement relationships from elasticity. Plane stress and plane strain finite elements. Lagrange interpolation and Lagrange based element families. Introduction to the theory of thin plates; overview at plate bending elements. General formulation of the finite element method. Also offered at the undergraduate level, with different requirements, as Engineering 82.421★, for which additional credit is precluded.

Engineering 82.514 (CVG7123)

### Earthquake Engineering and Analysis

Advanced topics in earthquake engineering: description of earthquake motions, seismological background; analysis of earthquake response, response spectrum approach, multiple input excitation, extended Ritz coordinates, complex eigen-problem analysis; response analysis via frequency domain; design considerations and code requirements, earthquake forces in building codes; dynamic soil-structure interaction, direct method, substructure method, fundamentals of wave propagation, half-space modelling of soil; dynamic fluid-structure interaction, incompressible and compressible fluid elements, substructure method with liquid continuum; special topics of current interests.

Prerequisite: Engineering 82.516 or permission of the Department.

Engineering 82.515 (CVG7124)

### Advanced Finite Element Analysis in Structural Mechanics

Fundamentals of calculus of variations; variational and Galerkin formulations: assumed displacement, assumed stress and hybrid elements; isoparametric elements and numerical integration; plate bending: convergence, completeness and conformity, patch test, Kirchhoff and Mindlin plate theories, nonlinear elasticity and plasticity; cracking and non-linearities in reinforced concrete structures; incremental and iterative schemes, geometric non-linearity: small strain-large displacement, large strain-large displacement, Eulerian and Lagrangian formulations; finite elements in dynamics; finite element programming.

Prerequisite: Engineering 82.513 or permission of the Department.

Engineering 82.516 (CVG7137)

### **Dynamics of Structures**

Structural dynamics, single and multi-degree-of-freedom systems, formulation of equations of motion, methods of analytical mechanics, free and forced vibrations, normal mode analysis, numerical methods for the response analysis of single and multiple-degree-of-freedom systems.

Engineering 82.520 (CVG7138)

### **Engineered Masonry Behaviour and Design**

Properties of masonry materials and assemblages. Behaviour and design of walls, columns and lintels. Treatment of specialized design and construction topics. Design of lowrise and highrise structures. Discussion of masonry problems. Emphasis throughout the course is placed on a practice-oriented approach. Also offered at the undergraduate level, with different requirements, as Engineering 82.443★, for which additional credit is precluded.

Engineering 82.523 (CVG7125)

### **Theory of Structural Stability**

Elastic and inelastic behaviour of beam-columns; elastic and inelastic buckling of frames; application of energy methods to buckling problems; lateral-torsional buckling of columns and beams; buckling of plates; local buckling of columns and beams.

Prerequisite: Engineering 82.525 or equivalent.

Engineering 82.524 (CVG7126)

### **Behaviour and Design of Steel Structures**

Limit states design philosophy; material behaviour; tension members; plate buckling; torsion; lateral torsional buckling; beams, axially loaded columns and beam-column behaviour; brittle fracture and fatigue; frame stability and second order effects.

Engineering 82.525 (CVG7127)

### **Advanced Modelling and Analysis of Structures**

Matrix structural analysis; force and displacement method of analysis for planar and space structures; symmetric and anti-symmetric structures; analysis of nonlinear structures: geometric and material nonlinearities; large displacement theory and iteration strategy.

Engineering 82.526 (CVG7128)

### **Prestressed Concrete**

Prestressed concrete materials; working stress design for flexure; ultimate strength design for flexure, shear, and torsion; prestress losses; deflection and camber; slabs; indeterminate beams and frames; introduction to prestressed bridges and circular tanks.

Engineering 82.528 (CVG7130)

### **Advanced Reinforced Concrete**

The research background, development, and limitations in current building code provisions for reinforced concrete; yield line theory of slabs; safety and limit state design; computer design of concrete structures.

Engineering 82.529 (CVG7100)

### **Case Studies in Geotechnical Engineering**

The critical study of case histories relating to current procedures of design and construction in geotechnical engineering. The importance of instrumentation and monitoring field behaviour will be stressed. In-situ testing.

Engineering 82.530 (CVG7101)

### **Advanced Soil Mechanics**

Effective stress, pore pressure parameters, saturated and partially saturated soils; seepage; permeability tensor, solutions of the Laplace equation; elastic equilibrium; anisotropy, non-homogeneity, consolidation theories; shear strength of cohesive and cohesionless soils; failure and yield criteria.

Engineering 82.533 (CVG7160)

### **Pavements and Materials**

An analysis of the interaction of materials, traffic, and climate in the planning, design construction, evaluation, maintenance, and rehabilitation of highway and airport pavements.

Engineering 82.534 (CVG7150)

### **Intercity Transportation, Planning and Management**

Current modal and intermodal issues, including energy. Framework and process of intercity transport planning and management. Recent trends and system development. Passenger and freight demand and service characteristics. Future prospects and possibilities.

Engineering 82.535 (CVG7151)

### **Traffic Engineering**

Introduction to principles of traffic engineering. Basic characteristics of drivers, vehicles, and traffic. Volume, speed, and delay studies. Traffic stream characteristics and queuing theory. Capacity analysis of roads and intersections. Safety.

Engineering 82.536 (CVG7152)

### **Highway Materials**

Materials characterization and strength evaluation of soils, stabilized soils, aggregates, and asphalt concrete. Effects of low temperatures and frost on materials behaviour.

Engineering 82.537 (CVG7153)

### **Urban Transportation, Planning and Management**

Urban transportation systems, planning and



management. Urban development models, an introduction. Urban transportation policy.

Engineering 82.538 (CVG7154)

**Geometric Design**

Basic highway geometric design concepts. Vertical and horizontal alignment. Cross-sections. Interchange forms and design. Adaptability and spacing of interchanges. Design of operational flexibility; operational uniformity, and route continuity on freeways.

Engineering 82.539 (CVG7155)

**Transportation Supply**

Advanced treatment of transportation planning and management concepts and techniques: transport supply issues, capacity and costs, evaluation of system improvements and extensions, transportation and development, policy impact analysis.

Engineering 82.541 (CVG7156)

**Transportation Economics and Policy**

Transportation, economic analysis framework. Transport industry output. Carrier operations. Issue of resource utilization, measurement, economics, supply of infrastructure, pricing; subsidies, externalities. Transport policy in Canada.

Engineering 82.542 (CVG7159)

**Transportation Terminals**

Framework for passenger terminal planning and design. Theory: the transfer function and network modelling; pedestrian flow characteristics; capacity of corridors, stairs, escalators, and elevators; layout planning. Practical applications: air, rail, metro, bus, ferry, and multi-modal terminals.

Engineering 82.543 (CVG7158)

**Airport Planning**

Framework for airport planning and design. Aircraft characteristics; demand forecasting; airport site selection; noise, airside capacity; geometric design; the passenger terminal complex; cargo area; general aviation; ground transportation; land use planning.

Engineering 82.550 (CVG7154)

**Earth Retaining Structures**

Approaches to the theoretical and semi-empirical analysis of earth retaining structures. Review of the earth pressure theories. Analysis and design methods for rigid and flexible retaining walls, braced excavations, and tunnels. Instrumentation and performance studies.

Engineering 82.551 (CVG7105)

**Foundation Engineering**

Review of methods of estimating compression and shear strength of soils. Bearing capacity of shallow and deep foundations. Foundations in slopes. Pile groups. Use of in-situ

testing for design purposes.

Engineering 82.552 (CVG7106)

**In-Situ Methods in Geomechanics**

Scope of a subsurface exploration program. Techniques of soil and rock sampling. Geophysical methods. Mechanical and hydraulic properties of soil and rock. In-situ determination of strength, deformability and permeability of soils and rocks. Critical evaluation of vane, pressuremeter, screw plate, flat dilatometer, borehole shear and plate load tests. Pumping, recharge and packer tests. Permeability of jointed rocks. Rock testing techniques, borehole dilatometer, flat jack, cable jacking tests. Properties of rock joints. In-situ stress measurements.

Engineering 82.553 (CVG7107)

**Numerical Methods in Geomechanics**

Critical review of advanced theories of soil and rock behaviour. Linear elasticity, non-homogeneity and anisotropy. Plasticity models. Generalized Mohr-Coulomb and Rucker-Prager failure criteria. Critical state and cap models. Dilatancy effects. Associative and non-associative flow rules. Hardening rules, hypo-elasticity. Soil consolidation, visco-elasticity and creep behaviour of rock masses. Rock joints. Finite element formulation of nonlinear problems. Iterative schemes; tangent stiffness, initial stress and initial strain techniques, mixed methods. Time marching schemes. Solution of typical boundary value problems in geomechanics with the aid of existing research class finite element codes.

Prerequisite: Engineering 82.511, 82.513, or permission of the Department.

Engineering 82.554 (CVG7108)

**Seepage and Waterflow through Soils**

Surface-subsurface water relations. Steady flow. Flownet techniques. Numerical techniques. Seepage analogy models. Anisotropic and layered soils. Water retaining structures. Safety against erosion and piping. Filter design. Steady and non-steady flow towards wells. Multiple well systems. Subsidence due to ground water pumping.

Engineering 82.560 (CVG7131)

**Project Management**

Introduction to managing the development, design, and construction of buildings. Examination of project management for the total development process, including interrelationships among owners, developers, financing sources, designers, contractors, and users; role and tasks of the project manager; setting of project objectives; feasibility analyses; budgets and financing; government regulations; environmental and social constraints; control of cost, time, and content quality and process; human factors.

Engineering 82.561 (CVG7140)

### **Statistics, Probabilities and Decision-Making Applications in Civil Engineering**

Review of basic concepts in statistics and the Theory of Probabilities. Bayes' Theorem. Probability distributions. Moments. Parameter Estimation. Goodness-of-fit. Regression and correlation. OC curves. Monte Carlo simulation. Probability-based design criteria. Systems reliability. Limit States Design. Selected applications in transportation, geomechanics, and structures. Emphasis will be given to problem solving. Use of existing computer software.

Engineering 82.562 (CVG7141)

### **Advanced Methods in Computer-Aided Design**

Representation and processing of design constraints (such as building codes and other design rules); decision tables; constraint satisfaction. Automatic integrity and consistency maintenance of design databases; integrated CAD systems. Introduction to geometric modelling. Introduction to artificial intelligence.

Engineering 82.565 (CVG7143)

### **Design of Steel Bridges**

Basic features of steel bridges, design of slab-on-girder, box girder and truss bridges. Composite and non-composite design. Introduction to long span suspension and cable-stayed bridges. Discussion of relevant codes and specifications.

Engineering 82.566 (CVG7144)

### **Design of Concrete Bridges**

Concrete and reinforcing steel properties, basic features of concrete bridges, design of superstructure in reinforced concrete slab, slab-on-girder and box girder bridges, an introduction to prestressed concrete bridges, design of bridge piers and abutments. In all cases the relevant provisions of Canadian bridge codes are discussed.

Engineering 82.567 (CVG7145)

### **Introduction to Bridge Design**

Limit states design of highway bridges; methods of analysis, design and evaluation procedures of bridge superstructure components; bridge design codes (OHBD and CHBD); design loads and load factors; concrete deck design; load distributions; computer analysis; impact and dynamics; fatigue and brittle fracture; construction bracing; load capacity rating of existing bridges.

Engineering 82.568 (CVG 7146)

### **Introduction to Fire Protection Engineering**

Introduction to basic chemistry and physics of fire; fire growth and fire severity in build-

ings; simple models for the prediction of the course of a building fire; reaction of building components to exposure by fire; design of fire safe buildings

Engineering 82.570 (CVG7160)

### **Biofilm Processes in Wastewater Treatment**

Physical and chemical properties of biofilms; microbial ecology of biofilms; biofilm processes, attachment, growth, sloughing; transport and interfacial transfer phenomena; mass transfer models, mass transport in biofilms, deposition of solids; modeling biofilm systems; single and multiple species models, mass balance equations, boundary conditions, moving boundary problem, analytical and numerical solutions; case studies.

Engineering 82.571 (CVG7161)

### **Traffic Related Air Pollution**

Pollutant formation, emission characterization, emission control technology and emission modeling from motor vehicles; dispersion and receptor modeling for conservative pollutants in urban microenvironments; personal exposure and health risk assessment.

Engineering 82.572 (CVG7162)

### **Ambient Air Quality and Pollution Modelling**

Dispersion modelling for simple and complex sources and complex terrain; physical and chemical transformations for pollutants in the atmosphere; urban and regional air pollution modelling for reactive pollutants; the urban air shed model; regional air quality modelling case studies.

Engineering 82.573 (CVG7163)

### **Case Studies in Hydrogeology**

Development of a conceptual model; chemistry, geology and hydrology, site characterization, initial and boundary conditions; application of industry-recognized computer codes to model flow and contaminant transport at a particular site; evaluation of remedial alternatives at a site; modeling of the more common remediation technologies (soil vapour extraction, air sparging, pump and treat, biodegradation).

Engineering 82.574 (CVG7164)

### **Hazardous and Radioactive Waste Management**

Classification of hazardous, radioactive and mixed wastes, hazardous waste treatment processes, wastes generated in the nuclear fuel cycle, radioactive waste classification, radioactive waste treatment and management of residuals, engineered systems for long-term isolation and disposal, mixed waste management.

Engineering 82.575 - 82.579 (CVG7300-7304)  
**Special Topics in Structural Engineering**  
 Courses in special topics related to building design and construction, not covered by other graduate courses; details will be available some months prior to registration.

Engineering 82.580 - 82.584 (CVG7305-7309)  
**Special Topics in Geotechnical Engineering**  
 Courses in special topics in geotechnical engineering, not covered by other graduate courses; details will be available some months prior to registration.

Engineering 82.580 (CVG7305)  
**Analysis of Embankments and Slopes**  
 Stability of embankments of soft clays; stress-strain analysis; anisotropy; strain rate effect; short and long-term settlement; methods of slope stability analysis; progressive failure; use of stability charts; slope analysis for residual and unsaturated soils.

Engineering 82.585 - 82.589 (CVG7310 - 7314)  
**Special Topics in Transportation Planning and Technology**  
 Courses in special topics in transportation engineering, not covered by other graduate courses; details will be available some months prior to registration.

Engineering 82.590  
**Civil Engineering Project**  
 Students enrolled in the M.Eng. program by course work will conduct an engineering study, analysis, or design project under the general supervision of a member of the Department.

Engineering 82.596  
**Directed Studies**

Engineering 82.597  
**Directed Studies**

Engineering 82.599  
**M.Eng. Thesis**

Engineering 82.699  
**Ph.D. Thesis**

## Other Courses of Particular Interest

*Mechanical and Aerospace Engineering*  
 88.514, 88.517, 88.521, 88.550, 88.561, 88.562, 88.568

*Systems and Computer Engineering*  
 94.501

*Geography*  
 45.415 Slope Development: Forms, Processes and Stability

45.417 Glacial Geomorphology

45.532, 45.533, 45.534

*Public Administration*  
 50.510, 50.511



## Cognitive Science

Institute of Interdisciplinary Studies  
Duntun Tower 2216  
Telephone: 520-2368  
Fax: 520-3985  
Email: iis@carleton.ca

### The Institute

**Director of the Institute, J. Andrew Brook**

**Director of the Cognitive Science Doctoral Program, To be announced**

The Institute of Interdisciplinary Studies offers a program of study and research leading to the degree of Doctor of Philosophy in Cognitive Science.

The School of Computer Science and the Departments of Psychology, Linguistics and Applied Language Studies, and Philosophy participate in the doctoral program.

The program offers two fields of study:

- \* language and cognition
- \* representation and learning

The field of language and cognition includes the following sub-fields: linguistic theory, psycholinguistics, linguistic methodology, philosophy of language, the mind's processing of language, acquisition of language and other symbolic systems, memory and language, text analysis, computational linguistics, natural language processing, and alternative architectures.

The field of representation and learning includes the following sub-fields: the mind's cognitive resources and how it uses them, memory, vision, attention, the psychophysics and neural foundations of cognition, philosophical theories of representation, history of cognitive science, evolutionary approaches to cognition, knowledge representation, computer simulations of memory constraints, expert systems, case-based systems, genetic algorithms, heuristic theorems, neural networks, support systems for cognitive processes, and machine learning

### Members of the Cognitive Science Doctoral Program

- \* Andrzej Bieszcza, *Artificial Intelligence*
- \* Andrew Brook, *Philosophy of Mind and Language, Kant, History of Cognitive Science*
- \* Murray Clarke, *Philosophy of Mind* (Concordia - Adjunct)
- \* Jean-Pierre Corriveau, *Natural Language Processing, Time-constrained Memory and*

### Text Comprehension

- \* Bruno Emond, *Artificial Intelligence* (University of Quebec at Hull - Adjunct)
- \* Helen Goodluck, *Language Acquisition and Processing* (Ottawa - Adjunct)
- \* Chris Herdman, *Word Recognition, Phonemic and Lexical Processing, Attention and Word Recognition*
- \* Marie-Odile Junker, *Conceptual Semantics, Semantics of Quantifiers*
- \* J.B. Kelly, *Sensory Neuroscience and Related Issues in the Biological Foundations of Cognition*
- \* G.F. Kersten, *Complex Decision-making, Support Systems for Cognitive Processes*
- \* W.R. Lalonde, *Artificial Intelligence, Connectionism, Cerebral Computation*
- \* Ann Laubstein, *Speech-production Models, Phonology, Speech Recognition Algorithms*
- \* Jo-Anne Lefevre, *Numerical and Lexical Cognition*
- \* John Logan, *Spoken Language Perception, History of Cognitive Science*
- \* Stanislas Matwin, *Symbolic Machine Learning* (Ottawa - Adjunct)
- \* Franz Oppacher, *Genetic Approaches to Cognition, Genetic Algorithms, Natural Language and Knowledge-based Systems, Machine Learning, Computational Linguistics*
- \* Lise Paquet, *Visual Perception*
- \* W.M. Petrusic, *Psychophysics of Cognition Science*
- \* Charles Reiss, *Linguistics* (Concordia - Adjunct)
- \* Monique Sénéchal, *Vocabulary Acquisition*
- \* Douglas Skuce, *Knowledge Engineering, Semantics of Natural Languages, AI and Ontology* (Ottawa - Adjunct)
- \* Robert Stainton, *Philosophy of Language and Linguistics, Pragmatics and Semantics*
- \* Lew Stelmach, *Vision and Attention* (Communication Research Centre) (Adjunct)
- \* Stanislas Szpakowicz, *Computational Linguistics, Knowledge Acquisition, Decision Support Systems* (Ottawa - Adjunct)
- \* Andre Vellino, *Artificial Intelligence* (Nortel-Adjunct)
- \* Helmut Zobl, *Knowledge Representation, Second-language Acquisition and Processing*

## Admission Requirements

The requirements for admission into the Ph.D. program is a master's degree (or the equivalent) from one of the participating disciplines, an Honours degree from a participating discipline, a combined Honours degree (or the equivalent) from two of the participating disciplines or an Honours degree in cognitive science. Students with an Honours bachelor's degree from another discipline with a significant focus on cognition may also apply.

Normally, a substantial proportion of an applicant's work will have been in natural and/or artificial cognition.

Applicants with a master's degree are normally admitted to a 10.0 credit program while applicants with a bachelor's degree are admitted to a 15.0 credit program.

Students who are eligible for admission to the 10.0 credit program but who have deficiencies may be required to take additional courses. In some circumstances, these students will be admitted to the 15.0 credit program.

An average of *A-* or better in relevant courses is normally required.

Applicants whose first language is not English must demonstrate a fluent knowledge of English. This is normally satisfied by passing a TOEFL test with a score of 580 or better. (See p. 52.)

Before admission, a candidate must submit a description of his or her proposed area of thesis research and a member of the core faculty must indicate in writing that he or she is willing to supervise the student.

## Program Requirements

Program requirements for the Ph.D. degree are outlined in the General Regulations section of this Calendar.

All doctoral students must successfully complete:

- \* Cognitive Science 07.680 (1.0 credit)
- \* 2.0 credits in the area of cognition from the course offerings of at least three of the four participating academic units and other than those offered by the cognitive science program.
- \* Cognitive Science 07.690 (1.0 credit)
- \* Cognitive Science 07.695 (1.0 credit)
- \* a second language if required (see below)
- \* a thesis (equivalent to 5.0 credits) which must be defended at an oral examination

In addition, students in the 15.0 credit doctoral program in cognitive science must successfully complete:

\* Cognitive Science 07.501, 07.502, 07.503 and 07.504

\* Psychology 49.520

\* 2.0 credits in the area of cognition at the 500- and 600-level, chosen from the course offerings of at least three of the four participating academic units

To enter the final 10.0 credits of the program, students must complete these courses with *B+* or better. Students with a strong background in any of these required areas may apply to be exempted.

## Comprehensive Examinations

The comprehensive examination consists of three parts. Each part must be completed in a different participating discipline (Psychology, Computer Science, Linguistics and Applied Language Studies or Philosophy). Under special circumstances another discipline may be substituted.

The purpose of the comprehensive examination is to provide a student with background in a number of approaches to cognition adequate for his or her thesis.

The comprehensive examination is graded as Passed with Distinction/Satisfactory/Unsatisfactory. If any part is graded Unsatisfactory, the student may resubmit the final assignment only one time.

As part of preparation for the comprehensive examination, the student must spend one term in a laboratory or other research venue in each of the three chosen disciplines.

## Thesis

A thesis committee is created prior to completion of the comprehensive examination. The committee is comprised of the thesis supervisor, one faculty member from outside the department, one other member of the core faculty and the director of the program, *ex officio*.

Normally students will conduct the research for their thesis in the research facilities of their supervisor.

A thesis proposal, prepared in accordance with the guidelines of the thesis supervisor's discipline, must be defended at an oral examination.

The thesis must be defended at an oral examination.

## Residence Requirement

All Ph.D. candidates must be registered full-time in a minimum of six terms to satisfy the residence requirement (nine terms in the case of a 15.0 credit program).

## Language Requirement

A second language is required when relevant to the student's program of research. Whether a second language is required and the level of proficiency expected will be determined at the time of admission based on the student's description of his or her proposed area of thesis research.

## Guidelines for Completion of the Ph.D. Degree

All students must complete Cognitive Science 07.680 and will normally complete the required 2.0 credits within three terms of beginning the final 10.0 credits of the program. Cognitive Science 07.690 must be completed within six terms of beginning the final 10.0 credits of the program.

The first part of the comprehensive examination must be completed by the end of the fourth term after beginning the 10.0 credit program or the final 10.0 credits of the 15.0 credit program. The remaining two parts must be completed within an additional two terms.

Students in the 10.0 credit doctoral program will normally complete the degree in twelve terms of full-time study. Students in the 15.0 credit doctoral program will normally complete the degree in fifteen terms of full-time study.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

### Area Seminars

The purpose of an area seminar is to offer an advanced survey of one of the four participating disciplines.

Cognitive Science 07.501F1,W1,S1

### Cognition and Artificial Cognitive Systems

An introduction to the contribution of arti-

cial intelligence and computer modelling of cognitive processes to cognitive science. (Also listed as Computer science 95.510)

Cognitive Science 07.502F1,W1,S1

### Experimental Research in Cognition

An introduction to the contribution of experimental psychology and neuroscience to cognitive science. (Also listed as Psychology 49.570)

Cognitive Science 07.503F1,W1,S1

### Cognition and Language

An introduction to the contribution of theoretical linguistics and linguistic research to cognitive science. (Also listed as Linguistics and Applied Language Studies 29.561).

Cognitive Science 07.504F1,W1,S1

### Cognition and Conceptual Issues

An introduction to the contribution of philosophy of mind, philosophy of language, and other conceptual investigations to cognitive science. (Also listed as Philosophy 32.520)

## Core Seminars

Cognitive Science 07.680T2

### Proseminar in Cognitive Science

An intensive survey of the central problems and issues of natural and artificial cognition and a brief examination of contemporary neuroscience. Compulsory in the first year of the final 10.0 credits. Students are required to complete the proseminar in the first year of registration.

Cognitive Science 07.690T2

### Research Seminar in Cognitive Science

A full-credit seminar course devoted to the research of students, faculty, and guests of the cognitive science doctoral program. Normally a different researcher will present each week. Compulsory in the second year of the final 10.0 credits. Students in other years are expected to attend on a regular basis.

Cognitive Science 07.691F1,W1,S1

### Directed Studies in Cognitive Science I

Cognitive Science 07.692F1,W1,S1

### Directed Studies in Cognitive Science II

Cognitive Science 07.695F2,W2,S2

### Comprehensive Examination

Cognitive Science 07.699F,W,S

### Ph.D. Thesis

## Selection of Courses in Related Disciplines

Students may register in courses in the area of cognition offered by any of the participating departments, including Computer Science, Psychology, Linguistics, and Philosophy. Students may also register in courses offered by



the University of Ottawa, subject to the General Regulations. Please note that not all courses are offered every year and some courses have limited enrolment. Students are advised to consult the Institute for scheduling details.

Courses prefixed by a number are offered at Carleton, by letters at the University of Ottawa.

#### *Computer Science Courses*

95.505 (CSI5390), 95.506 (CSI5306), 95.507 (CSI5307), 95.510 (CSI5180), 95.520 (CSI5182), 95.526 (CSI5183), 95.587 (CSI5104), 95.664 (CSI7162), 95.691 (CSI7901)

- CSI5101 (95.561) Formal Models of Computational Systems
- CSI5162 (95.572) Topics in the Theory of Computing Artificial Intelligence
- CSI5181 (95.575) Applications in software Development
- CSI5184 (95.584) Logic Programming
- CSI5304 (95.562) Knowledge Engineering
- CSI5386 (95.555) Natural Language Processing
- CSI5387 (95.576) Concept Learning Systems
- CSI5388 (95.581) Topics in Machine Learning
- CSI5510 (95.577) Formal Principles of Software Development
- CSI5580 (95.510) Subject in Artificial Intelligence

#### *Psychology (Cognitive Psychology)*

49.516, 49.530, 49.531, 49.543, 49.547, 49.570, 49.573, 49.574, 49.626, 49.661, 49.662, 49.663, 49.665, 49.670

#### *(Neuroscience)*

49.520, 49.620, 49.623, 49.624, 49.625, 49.664, 49.666

#### *Linguistics and Applied Language Studies*

29.545, 29.561, 29.564, 29.571, 29.592, 29.597  
 LIN5915 Phonology  
 LIN5917 Syntax  
 LIN5918 Semantics  
 LIN6915 Topics in Phonological Theory  
 LIN6917 Syntax  
 LIN7901 Psycholinguistics  
 LIN7951 Topics in Applied Linguistics.

#### *Philosophy*

32.520, 32.514, 32.515, 32.524, 32.525, 32.534, 32.535

## School of Languages, Literatures and Comparative Literary Studies: Comparative Literary Studies

Dunton Tower 1416  
Telephone: 520-2177  
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E-mail: comp\_lit@carleton.ca

**Associate Director, Gurli A. Woods**

**Supervisor of Graduate Studies, F.G. Loriggio**

Comparative Literary Studies offers programs of graduate study leading to the degrees of Master of Arts and Doctor of Philosophy in Comparative Literary Studies.

The purpose of the program in comparative literature is to study literature in its international context, and to relate and compare literary phenomena usually studied in isolation because of linguistic barriers and the traditional departmental division of academic disciplines. Thus, taking into account the interrelation of all humanistic studies, such as the various literatures, philosophy, psychology, sociology, the visual arts, and history, comparatists view literary creation within the total complex evolution of world literature. The historical flow of literary archetypes, the role of folklore and myth in literature, recurrent problems of literary theory, and consideration of the less well known literatures of the world are some of the objects of comparative literary studies.

### Qualifying-Year Program

The regulations governing admission to the qualifying-year program are outlined in the General Regulations section of this Calendar.

Applicants will normally have the equivalent of a Combined Honours BA with high honours standing.

The total course program must be determined in consultation with the supervisor of graduate studies. Formal admission to the master's program may be considered at the end of the first term.

### Master of Arts

#### Admission Requirements

The regulations governing admission to the M.A. program are outlined in the General Regulations section of this Calendar (see p. 51).

The specific requirements for admission to the M.A. program in Comparative Literary Studies are as follows:

\* An Honours B.A. degree (or the equivalent) with at least high honours standing in a literature (studied in the original language) or in two literatures or in a literature and a related arts subject

\* Proficiency in English

\* An ability to work at the graduate level in an additional language approved by Comparative Literary Studies. Students whose record does not clearly demonstrate this ability will be required to take as part of their program at least 0.5 credit in the literature of this second language in the original language

### Program Requirements

Master's candidates in Comparative Literary Studies will follow one of two 5.0 credit options:

*Thesis Program:*

\* Comparative Literary Studies 17.501 (0.5 credit), and 17.502 (0.5 credit)

\* 1.5 credits at the 500-level selected from those courses offered by Comparative Literary Studies (max. 0.5 credit Directed Studies included)

\* 0.5 credit at the 500-level selected from any course offered in Comparative Literary Studies or from other programs in the University with the approval of the graduate committee.

\* 17.599 (2.0 credits)

*Non-Thesis Program*

\* Comparative Literary Studies 17.501 (0.5 credit), and 17.502 (0.5 credit)

\* 2.5 credits at the 500-level selected from those courses offered by Comparative Literary Studies (max. 0.5 credit Directed Studies included)

\* 0.5 credit at the 500-level selected from any course offered in Comparative Literary Studies or from other programs in the University with the approval of the graduate committee.

\* 17.593 (1.0 credit)

### Guidelines for Completion of Master's Degree

The master's program is normally completed no later than two years or six terms after initial full-time registration and six years or eighteen terms after initial part-time registration.

## Doctor of Philosophy

### Admission Requirements

*Please note: Admission to the Ph.D. program in Comparative Literary Studies has been suspended.*

The normal requirement for admission to the Ph.D. program is an M.A. degree in literary studies (or in related subjects approved by Comparative Literary Studies) with at least high honours standing, normally with no grade below B-.

Each applicant must supply proof, by means of a research effort that has resulted in an extensive essay, that he or she is capable of producing a publishable paper. Such proof will be submitted at the time of application to the program.

Students admitted into the program with a master's degree earned in another department or institution will be required to make up any deficiencies in course work as required by Comparative Literary Studies.

In exceptional cases, an outstanding student who has completed the B.A. Honours degree and who meets the language requirements outlined below, may be admitted directly to the doctoral program. The program requirement for these students is normally 15.0 credits.

A student who transfers from the master's program in Comparative Literary Studies must meet the language requirements on admission as well as those listed under program requirements.

Applicants must demonstrate a capacity to work at the graduate level in at least two languages other than English. The two languages must be approved by Comparative Literary Studies. Normally, one of the two languages must be French. Applicants must also be proficient in English. Students whose native tongue is not English may be required to pass the TOEFL test with a minimum score of 600.

### Program Requirements

\* 3.0 credits at the 600-level to be chosen from courses offered by the discipline. (0.5 credit may be at the 500-level.)

\* 0.5 credit at either the 500- or 600-level in the social sciences to be approved by the graduate adviser.

\* 0.5 credit at the 600-level outside the area of specialization of the student to be chosen from the courses offered by the discipline.

\* A 1.0 credit comprehensive examination,

both oral and written parts to be taken prior to the approval of the Ph.D. thesis prospectus.

\* A thesis equivalent to 5.0 credits.

### Comprehensive Examinations

The comprehensive examination is designed to test the candidate's competence both in comparative literary theory and in the chosen area of specialization. The comprehensive examination is to be completed after course requirements for the Ph.D. have been completed.

Students admitted to the program who have a master's degree in the area of literary studies (or in related subjects approved by Comparative Literary Studies) must normally satisfy the comprehensive examination requirement by the end of the third term in the program.

Those students either admitted directly into the program from the B.A. Honours program or transferring from the master's to the doctoral program must satisfy the comprehensive examination requirement no later than the end of the third year or ninth term of study.

Normally the comprehensive examination must be completed no later than four years or twelve terms after the initial part-time registration following the M.A. (or equivalent).

Students admitted directly from the B.A. Honours program or transferring from the master's to the doctoral program must earn 15.0 credits beyond the B.A. honours and most of the master's program in Comparative Literary Studies, with the exception of the comprehensive examination which may be replaced by course work equivalent to 1.0 credit.

### Thesis

Comparative Literary Studies appoints a thesis supervisor and an advisory committee for each doctoral candidate. A minimum of two faculty members will constitute the thesis advisory committee and one of the two members will be from outside Comparative Literary Studies. Both the thesis supervisor and the advisory committee determine when a thesis proposal may proceed to the graduate committee of Comparative Literary Studies for approval.

### Specialization Requirements

Each candidate must demonstrate competence in an area of specialization chosen from the following list: postmodernism, post-colonialism, feminism, gender and literature, the Hebrew Bible, intellectual history, Latin Ameri-



can literature, literary history, literary theory, literature and historical studies, literature and linguistics, literature and religious studies, literature of the Francophonie, literature written in English, language and social sciences, medieval and early renaissance Hispanic literature, modern theatre and dramatic literature, nineteenth- and twentieth-century French literature, nineteenth- and twentieth-century German literature, nineteenth- and twentieth-century Italian literature.

Candidates who enter the Ph.D. program with a master's degree in a special area or discipline, and who wish to either continue in that area or discipline or choose another specialization in their doctoral program, will be tested in their chosen area in the specialization portion of the comprehensive examination.

Candidates admitted directly from a B.A. Honours program or transferring from the master's to the doctoral program will be required to take the equivalent of 3.0 credits in the area of specialization, and will be tested in this area in the specialization portion of their comprehensive examination.

### Language Requirement

Doctoral students must acquire a reading knowledge in a third language, to be approved by Comparative Literary Studies, before beginning the comprehensive examination. Candidates must successfully complete either 0.5 credit at the master's level in the literature(s) of that language (extra-to-the-degree) or a reading proficiency test administered by Comparative Literary Studies.

### Academic Standing

All candidates are required to maintain a GPA of B-.

Of the 10.0 credits required beyond the master's level, no more than 1.0 credit may be at the 500-level.

### Guidelines for Completion of Doctoral Degree

Students admitted with a B.A. (Honours) degree and registered full-time must normally complete the comprehensive examination requirement by the end of the third year or ninth term of full-time study. The thesis proposal must normally be presented after three and one-half years or ten terms of study.

Students admitted with a master's degree and registered full-time must normally complete the comprehensive examination requirement by the end of the third term of study. The

thesis proposal must normally be presented no later than the fourth term of study.

Students admitted with a B.A. (Honours) degree and registered part-time must normally complete the comprehensive examination requirement by the end of the ninth year or after twenty-seven terms of study after their initial part-time registration. The thesis proposal must normally be presented no later than ten years or thirty terms of study following the initial part-time registration.

Students admitted with a master's degree and registered part-time must normally complete the comprehensive examination requirement by the end of the fourth year or after twelve terms of study after the initial part-time registration. The thesis proposal must normally be presented no later than five years or fifteen terms of study after the initial part-time registration.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

A prerequisite for all graduate-level courses is appropriate linguistic ability and approval of Comparative Literary Studies.

A student will not receive credit for both a 0.5 credit course and a 1.0 credit course which bears the same topic title.

Comparative Literary Studies 17.501F1  
**Comparative Literature: History and Theory**  
Major developments within discipline of comparative literature from 19th to late 20th century; contributions of discipline to literary criticism; issues and problems today.  
Prerequisite: Permission of Comparative Literary Studies.

Comparative Literary Studies 17.502W1  
**Problems in the Theory of Literature**  
Study of key issues arising from the theoretical consideration of literary studies in modern or pre-modern criticism. For 1999-2000, the topic is: Discourse Analysis I: Classical and Medieval Rhetoric. Study of persuasion by the Greeks including a theory of what is called in the 20th Century "discourse analysis". Division by Aristotle of discourse into three

kinds: deliberative, forensic and epideictic prefigure distinction between oratory and literature, argumentation and poetry, historiography and fiction, mimesis and diegesis. Examples of theory of Classical and Medieval discourse as discussed by critics and practised by writers. (Also listed as Comparative Literary Studies 17.650.)

Prerequisite: Permission of Comparative Literary Studies.

Comparative Literary Studies 17.521F1

**Literary History: Periods, Styles and Movements I**

For 1999-2000, the topic is: Texts and Images from Antiquity to the Renaissance. The relationship between texts and images in the Western Tradition: Theoretical perspectives and historical survey. The "sister arts" in ancient rhetoric; memory and imagery. Case studies: from the pagan gods of Antiquity to Renaissance emblemata. The Canon vs. "Popular Culture". (Also listed as Comparative Literary Studies 17.655.)

Prerequisite: Permission of Comparative Literary Studies

Comparative Literary Studies 17.522F1 or W1

**Literary History Periods, Styles, and Movements II**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

Comparative Literary Studies 17.523 F1 or W1

**Literary History: Themes and Genres**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

Comparative Literary Studies 17.532F1 or W1

**Studies in the Literature of Identity**

For 1999-2000, the topic is: Female Identity: Writing by Women in the Twentieth Century. An exploration of topics such as gender and narrativity, women's space, marginalization, women and madness, and mothers and daughters in writing by women in the first half of the twentieth century in northern Europe and North America. The texts are discussed from a cross-cultural perspective with reference to poststructuralist literary theory, including feminist criticism.

Prerequisite: Permission of Comparative Literary Studies.

Comparative Literary Studies 17.554F1 or W1

**Comparative Perspectives on Literature and Globalization I**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

Comparative Literary Studies 17.556F1 or W1  
**Comparative Perspectives of Literature and Globalization II**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

Comparative Literary Studies 17.558W1

**Comparative Canadian Literature**

For 1999-2000, the topic is: Canadian Women's Autobiography. A study of narrative structures and of the markers of gender, as well as of national, ethnic, race and class difference in selected autobiographical works by English-Canadian and Québécois women writers. A knowledge of French is recommended but not required.

Prerequisite: Permission of Comparative Literary Studies.

Comparative Literary Studies 17.580F1

**Seminar in Comparative Literary Studies**

For 1999-2000, the topic is: Freudian Impulses on Literature and Culture. A critical examination of Sigmund Freud's intellectual heritage, including N. Abraham, B. Bettelheim, J. Kristeva, J. Lacan, J.-B. Pontalis and S. Zizek, focusing on psychoanalytic problems of literary and cultural studies.

Prerequisite: Permission of Comparative Literary Studies.

Comparative Literary Studies 17.582W1

**Seminar in Comparative Literature**

For 1999-2000, the topic is: Symbolism in Literary Analysis. The presuppositions of major symbolic systems (allegory, typology, emblematics) and their use in producing texts. Possibilities for and constraints upon symbolic interpretation, with the focus on Jung, Auerbach, Frye and Curtius, and some of their respective adherents.

Prerequisite: Permission of Comparative Literary Studies

Comparative Literary Studies 17.593F2,W2,S2

**Comprehensives**

Comparative Literary Studies 17.595F3, W3

**Study Abroad**

Under the terms of the accord with l'Université de Picardie in France, Università di Bari in Italy, Universität Leipzig in Germany, and Universidad Ibero-americana and Universidad Nacional Autónoma de México in Mexico, Universidad de Buenos Aires in Argentina, students may do a part of their work for the M.A. in Comparative Literary Studies in France, Italy, Argentina, Germany, or Mexico. The content of the study will be decided by Comparative Literary Studies at Carleton. Only students sponsored by Com-

parative Literary Studies under the exchange may take this course.

**Prerequisite:** Permission of Comparative Literary Studies.

### Comparative Literary Studies 17.597F1, W1, S1 **Directed Special Studies**

From time to time, students whose main interests are not covered by courses offered in a given year may pursue independent research, subject to the availability of a qualified adviser and relevant library resources at Carleton. Interested students should apply directly to the supervisor of graduate studies.

**Prerequisite:** Permission of Comparative Literary Studies 17.598.

### Comparative Literary Studies 17.599F4, W4, S4 **M.A. Thesis**

### Comparative Literary Studies 17.601F1

#### **Doctoral Seminar I: Literature and Other Discourses**

For 1999-2000, the topic is: Paratextuality: from Antiquity to Gutenberg. A study of the material presentation of written texts in the West. Evolution of material supports, layout, margins, illustrations, indexing and other aspects of paratextuality, including relations between scripta and text in the manuscript traditions of authors, such as Jean de Meun, Juan Ruiz and Petrarch.

**Prerequisite:** Permission of Comparative Literary Studies.

### Comparative Literary Studies 17.602 W1

#### **Doctoral Seminar II: Literature and Other Discourses**

For 1999-2000, the topic is: Agency in Literature and Other Discourses. The notion of agency in literary and other discourses (primarily anthropology and philosophy). Agency and humanism. Modern and postmodern debates on the notion. Among authors to be studied: Boccaccio, Machiavelli, Vico, Freud, Sapir, Beckett, Habermas, Foucault, Ricoeur, Archer.

**Prerequisite:** Permission of Comparative Literary Studies.

### Comparative Literary Studies 17.603F1 **Modernism**

For 1999-2000, the topic is: Literary Representations of the Passionate Self: Pragmatics, Semiotics and Cognition of Emotional Disclosure. Discourse of passion in poetry, drama and fiction. Perceptual processes of understanding; strategies of interpretation. Text selections from early modern to postmodern works.

**Prerequisite:** Permission of Comparative Literary Studies.

### Comparative Literary Studies 17.604F1

#### **Postmodernism**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

### Comparative Literary Studies 17.610W1

#### **Narrative and Non-Fiction**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

### Comparative Literary Studies 17.620F1 or W1

#### **Literary History**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

### Comparative Literary Studies 17.625F1 or W1

#### **Hermeneutics and Aesthetic Experiences of Literature**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

### Comparative Literary Studies 17.630W1

#### **Text Theory**

For 1999-2000, the topic is: Intertexts of Postmodern Fiction: Recent Challenges to Text Theory. An investigation of intertextual relations in postmodern American, Canadian, European, and Hispano-American fiction as a challenge to standard theories of textuality.

**Prerequisite:** Permission of Comparative Literary Studies.

### Comparative Literary Studies 17.635F1 or W1

#### **Translation Studies: Theory and Practice**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

### Comparative Literary Studies 17.640F1 or W1

#### **Gender and Literature**

Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

### Comparative Literary Studies 17.650W1

#### **Rhetoric and Literature**

For 1999-2000, the topic is: Discourse Analysis I: Classical and Medieval Rhetoric. Study of persuasion by the Greeks including a theory of what is called in the 20th Century "discourse analysis". Division by Aristotle of discourse into three kinds: deliberative, forensic and epideictic prefigure distinction between oratory and literature, argumentation and poetry, historiography and fiction, mimesis and diegesis. Examples of theory of Classical and Medieval discourse as discussed by critics and practised by writers. (Also listed as Comparative Literary Studies 17.502)

**Prerequisite:** Permission of Comparative Literary Studies



Comparative Literary Studies 17.655F1

**Iconicity and Medieval and Early Renaissance Literature**

For 1999-2000, the topic is: Texts and Images from Antiquity to the Renaissance. The relationship between texts and images in the Western Tradition: Theoretical perspectives and historical survey. The "sister arts" in ancient rhetoric; memory and imagery. Case studies: from the pagan gods of Antiquity to Renaissance emblemata. The Canon vs. "Popular Culture". (Also listed as Comparative Literary Studies 17.521.)

Prerequisite: Permission of Comparative Literary Studies.

Comparative Literary Studies 17.660F1 or W1  
**Sign, Language and Society**

For 1999-2000, the topic is: Sign, Theory, and the Interpretive Practice: A Multi-Media Seminar. This course explores different approaches to the relationship between signs and language, culture and social structure, with an emphasis on the contributions of anthropology. Scripts taken from different sources (myths, folk narrative, rituals, the scriptures, modern literature) and from different social and cultural contexts are examined with a view to illustrating various modes of interpretation and conflicting views on the nature and functions of signs in society.

Prerequisite: Permission of Comparative Literary Studies.

Comparative Literary Studies 17.683F1

**Seminar in Comparative Literary Studies**

For 1999-2000, the topic is: Space, Travel and Displacement in Literature and Other Discourses: Before Modernity. Historical, critical and theoretical questions pertaining to exile, emigration, exploration and other modes of travel in Western literature and other discourses (historiography, philosophy etc.) up to the early 1600s. Among the authors studied: Homer, Aeschylus, Herodotus, Vergil, Dante, Boccaccio and Montaigne.

Prerequisite: Permission of Comparative Literary Studies.

Comparative Literary Studies 17.684W1

**Seminar in Comparative Literary Studies**

For 1999-2000, the topic is: Space, Travel and Displacement in Literature and Other Discourses: The Twentieth Century. Historical, critical and theoretical questions pertaining to exile, emigration, colonialism, post-colonialism, tourism, nomadism and other modes of travel in twentieth century literature and related discourses (anthropology, geography, etc.) Among the authors studied: Achebe, Conrad, Forster, Joyce, Paci, Tan, Bakhtin, Deleuze, Lévi-Strauss and Said.

Prerequisite: Permission of Comparative Literary Studies.

Comparative Literary Studies 17.693F2,W2,S2  
**Comprehensives**Comparative Literary Studies 17.695F3,W3  
**Study Abroad**

Under the terms of the exchange agreements with the University of Picardie, the University of Bari, Universidad de Buenos Aires, Universität Leipzig, Universidad Iberoamericana, and Universidad Nacional Autónoma de México, students may do part of their work for the Ph.D. in Comparative Literary Studies in France, Italy, Argentina, Germany, or Mexico. The content and nature of the course involved will be decided by Comparative Literary Studies. Only students sponsored by Comparative Literary Studies under the exchange may take this course.

Comparative Literary Studies 17.699F, W, S  
**Ph.D. Thesis**

## Ottawa-Carleton Institute for Computer Science

Herzberg Building 5302

Telephone: 520-4333

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E-mail: [scs@carleton.ca](mailto:scs@carleton.ca)

Université d'Ottawa  
University of Ottawa



Carleton University

### The Institute

**Director of the Institute, S.J. Matwin**

**Associate Director of the Institute, D. Krizanc**

Students who wish to pursue studies in computer science leading to an M.C.S. or a Ph.D. degree can do so in a joint program offered by the School of Information Technology and Engineering at the University of Ottawa and the School of Computer Science at Carleton University under the auspices of the Ottawa-Carleton Institute for Computer Science. The Institute is responsible for supervising the program and for providing a framework for interaction between the two departments at the research level. In addition to the faculty members from the two computer science departments, the Institute also has members with computer science expertise from other departments.

The M.C.S. is also available as part of ConGESE (Consortium for Graduate Education in Software Engineering), a collaborative program offering a specialization in software engineering. This program is geared towards software professionals working for participating industrial partners. The ConGESE program imposes further regulations and requirements on the existing program. The degree will in each case specify the discipline of the participating unit with Specialization in Software Engineering. Additional information is available from the graduate supervisor.

Requests for information, and completed applications, should be sent to the director or associate director of the Institute. A joint admissions committee examines all applications and assigns students to the most appropriate campus and supervisor.

### Members of the Institute

The "home" department of each member is indicated by (SITE) for the School of Information Technology and Engineering, University of Ottawa; (ADM) for Faculty of Administration, University of Ottawa; (MCG) for the Department Of Mechanical Engineering, University of Ottawa; (SCS) for the School of Computer Science, Carleton University; (MAT)

for the School of Mathematics and Statistics, Carleton University; (SCE) for the Department of Systems and Computer Engineering, Carleton University; (C) for the Department of Civil and Environmental Engineering, Carleton University; (BUS) for the School of Business, Carleton University.

- \* M.D. Atkinson, *Complexity, Algorithms, Computational Algebra*(SCS-Adjunct)
- \* C. Barriere, *Natural Language Processing, Computational Lexicography, Knowledge Acquisition and Representation*(SITE)
- \* L.G. Birta, *Simulation, Optimization, Numerical Algorithms*(SITE)
- \* G. Bochmann, *Communication Protocols, Software Engineering, Formal Specifications, Verification and Validation, Distributed Applications and Systems Management, Multimedia, High-Speed Networks, Real-Time Systems*(SITE)
- \* P.Bose, *Applied Geometric Computing, Computational Geometry, Data Structures, Algorithms Design and Analysis, Randomized Algorithms, Graph Theory*(SCS)
- \* Sylvia Boyd, *Optimization, Combinatorics* (SITE)
- \* R.J. Buhr, *Software Design, Design Visualization, Real-Time and Distributed Systems, Object-Oriented Systems, Software Architecture, Use Case-Maps*(SCE)
- \* J.W. Chinneck, *Operations Research, Applied Optimization* (SCE)
- \* J.-P. Corriveau, *Cognitive Science, Natural Language Understanding, CASE Tools*(SCS)
- \* S.P. Dandamudi, *Parallel and Distributed Systems, Database Systems, Performance Evaluation, Computer Architecture, Operating Systems* (SCS)
- \* N.W. Dawes, *Diagnosis and Pattern Recognition* (SCE - Adjunct)
- \* Frank Dehne, *Computational Geometry, VLSI Algorithms*(SCS)
- \* D. Deugo, *Large-Scale Distributed Object Computing, Evolutionary Computation (Genetic Algorithms, Genetic Programming, Artificial Life), Object-Oriented Systems*(SCS)
- \* J.D. Dixon, *Algorithms, Algebra, Number Theory* (MAT)
- \* A.E.F. Fahim, *Nonlinear Optimization, CAD/CAM Methodology and Software, FMC Control Environment, Robot Control, Expert Systems for Design and Manufacturing*(MCG)
- \* Frantisek Fiala, *Combinatorial Algorithms, Vehicle Routing Problems, Software Tools*(SCS)

- \* N.D. Georganas, *Computer Communications, Mobile Radio*(SITE)
- \* Morris Goldberg, *Image Processing, Pattern Recognition*(SITE)
- \* R.C. Holte, *Artificial Intelligence, Machine Learning, Knowledge Compilation*(SITE)
- \* N.M. Holtz, *Computer-aided Structural Engineering*(C)
- \* A. Karmouch, *Multimedia Communications, Multimedia Real-Time Distributed Information Systems and Databases* (SITE)
- \* G.E. Kersten, *Knowledge-based Systems, Intelligent Decision Support, Problem Structuring and Representation* (BUS)
- \* Evangelos Kranakis, *Cryptography, Computational Number Theory, Combinatorial Analysis, Computational Geometry, Distributed Computing, Distributed and Data Networks* (SCS)
- \* Moshe Krieger, *Computer Architecture*(SITE)
- \* Danny Krizanc, *Parallel and Distributed Computing, Analysis of Algorithms and Use of Randomization in Computation* (SCS)
- \* T. Kunz, *Wireless and Mobile Computing, Load Balancing in Distributed Systems, Distributed Programming Environments for Parallel and Distributed Systems, Distributed Systems Management, Parallel and Distributed Debugging, Program Understanding* (SCE)
- \* R. Laganieri, *Computer Vision, Image Processing*(SITE)
- \* W.R. LaLonde, *Object-Oriented Systems, Design and Analysis Tools, Animation Systems*(SCS)
- \* T.C. Lethbridge, *Software Engineering, Human-Computer Interaction, Knowledge Representation*(SITE)
- \* Luigi Logrippo, *Software Methodology, Communications Protocols*(SITE)
- \* A. Maheshwari, *Data Structures and Algorithms, Parallel Computation, Computational Geometry, Graph Algorithms*(SCS)
- \* S.A. Mahmoud, *Wireless Communication Systems, Software Project Management, Protocols for High Speed Networks, Speech Processing and Computer Network Design*(SCE)
- \* S. Majumdar, *Parallel and Distributed Systems, Performance Evaluation, Operating Systems* (SCE)
- \* M.Marchand, *Computational Learning Theory, Machine Learning, Neural Networks*(SITE)
- \* S.J. Matwin, *Programming Languages, Expert Systems* (SITE)
- \* A. Mili, *Formal Specification, Program Transformation* (SITE)
- \* B.C. Mortimer, *Combinatorics, Algorithms, Groups Theory*(MAT)
- \* J. E. Neilson, *Distributed and Parallel Computing including: Operating Systems, Performance Models, and Design Tools; Simulation and Prototyping Methodology, Computer Systems Performance Engineering* (SCS-Adjunct)
- \* L.D. Nel, *Object-Oriented Programing and Object-Oriented Development, Computer Music and Multimedia*(SCS)
- \* J.B. Oommen, *Learning Systems, Stochastic Automata, Syntactic Pattern Recognition, Adaptive Data Structures, Neural Networks* (SCS)
- \* Franz Oppacher, *Artificial Intelligence, Genetic Algorithms, Evolutionary Computing, Machine Learning* (SCS)
- \* T.I. Ören, *Simulation, Modelling* (SITE)
- \* E.J. Otoo, *Databases, Algorithms* (SCS)
- \* Bernard Pagurek, *Communications Network Management, Artificial Intelligence and Fault Management, Knowledge-Based Software Debugging*(SCE)
- \* R.L. Probert, *Communications, Expert Systems* (SITE)
- \* J.R. Pugh, *Object-Oriented Development Environments*(SCS- Adjunct)
- \* Jacques Raymond, *Computer Architecture, Graphics*(SITE)
- \* Ivan Rival, *Combinatorics, Optimization, Algorithms*(SITE)
- \* J.-R. Sack, *Algorithms and Complexity, Computational Geometry, Geographic Information Systems, Parallel Computing, Graphics*(SCS)
- \* Nicola Santoro, *Distributed Computing, Fault-Tolerance, Discrete Chaos, Reactive Environments* (SCS)
- \* Philip Scott, *Logic, Theoretical Computer Science, Category Theory* (SITE)
- \* J.B. Sidney, *Combinatorics, Complexity, Computational Geometry* (ADM)
- \* D.R. Skuce, *Artificial Intelligence, Logic Programing*(SITE)
- \* Ivan Stojmenovic, *Computational Geometry, Multiple-valued Logics, Parallel Computing* (SITE)
- \* Stan Szpakowicz, *Logic Programing, Computational Linguistics*(SITE)
- \* D.A. Thomas, *Artificial Intelligence, Fifth Generation Machines*(SCS-Adjunct)



- \* Hasan Ural, *Software Reliability and Testing, Data Communication Protocols, Applications of Logic Programming*(SITE)
- \* Jorge Urrutia, *Algorithms, Combinatorics, Geometry And Algorithms*(SITE)
- \* Rémi Vaillancourt, *Numerical Methods*(SITE)
- \* G.M. White, *Networking, Office Automation* (SITE)
- \* C.M. Woodside, *Performance Modelling, Performance of Distributed Software, Software Design, Queuing Theory*(SCE)
- \* Ö. Yang, *Design, Modeling, Analysis and Performance Evaluation of Computer Communication Networks and their Architectures*(SITE)
- \* Negib Zaguia, *Optimization, Theory of Algorithms, Theory of Ordered Sets*(SITE)

## Master of Computer Science

### Admission Requirements

Applicants should have an Honours bachelor's degree in computer science or the equivalent, with at least high honours standing. By equivalent is meant an Honours degree in a program which includes at least twelve computer science half credits, two of which must be at the 400-level, as well as eight half credits in mathematics, one of which must be at the 300- or 400-level. These courses must include the topics indicated below:

#### *Computer Science*

Data structures/file management, operating systems, computer architecture, algorithm design and analysis, assembly language and two high-level languages

#### *Mathematics*

Calculus, linear algebra, algebraic structures or discrete mathematics, probability and statistics, numerical analysis. Applicants who have a general (3 year) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program. Refer to the General Regulations section of this Calendar for regulations governing the qualifying year.

### Program Requirements

The program includes graduate study and research in four broad areas identified as follows:

- \* Software Engineering
- \* Theory of Computing
- \* Computer Applications
- \* Computer Systems

Within these areas, the program emphasizes problems of current practical significance and has close links to the scientific and industrial communities.

Normally, students in the program will be expected to complete a thesis; however, students who have substantial relevant work experience may be permitted to take the non-thesis option, which must include a graduate research project course. Each candidate submitting a thesis will be required to undertake an oral defence of the thesis.

Students in the thesis option must take 2.5 credits, fulfill the graduate seminar requirement, and complete a thesis. Students in the non-thesis option must take 4.0 credits, plus a graduate project (a project is equal to 1.0 credit and may be completed in one or two terms), and fulfill the graduate seminar requirement. The course selections must be approved by the student's academic adviser, and must include at least:

- \* 0.5 credit in software engineering
- \* 0.5 credit in the theory of computing
- \* 0.5 credit in either computer applications or computer systems

The graduate seminar requirement includes a seminar presentation and participation in at least ten sessions in the joint graduate student seminar series.

Both course and thesis work may be completed either by full-time or part-time study.

A candidate may be permitted to carry out thesis work off campus provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the Institute.

### Guidelines for Completion of Master's Degree

The following completion times are estimates only, based on full-time study, and are intended to provide guidance only.

Students are strongly urged to check with the supervisor of graduate studies to determine the exact requirements of the degree program and other related information. Part-time students should calculate the completion times requirement by doubling the time estimates given below.

Students should complete the course work within the first two terms.

Selection of courses should be done in consultation with the student's faculty advisor. A thesis supervisor and a thesis topic must be

completion time for the M.C.S. degree is four selected by the end of the second term. The supervisor of graduate studies should be formally notified of this selection. The expected to six terms of full-time study depending on the type of thesis and the area of research.

## Doctor of Philosophy

### Admission Requirements

A master's degree in Computer Science (or the equivalent) with high second-class standing is normally required for admission into the Ph.D. program. Students who are currently registered in the M.C.S. program may, in exceptional cases, be permitted to transfer into the Ph.D. program if they have completed all course requirements with at least high second-class standing and demonstrate significant promise for advanced research.

### Program Requirements

- \* A minimum of 2.5 credits, at the graduate level which must include: 0.5 credit in software engineering; 0.5 credit in the theory of computing; 0.5 credit in either computer applications or computer systems
- \* Presentation of at least two seminars in the Ottawa-Carleton Institute for Computer Science seminar series
- \* A comprehensive examination involving breadth and depth components
- \* A written thesis proposal defended at an oral examination
- \* A research thesis, defended at an oral examination

### Guidelines for Completion of the Doctoral Degree

The following completion times are estimates based on full-time study, and are intended to provide guidance only.

During the first term, the thesis supervisor and the student must select courses. Course selection must be submitted for approval to the director or associate director of the Institute. An advisory committee comprised of three to five faculty members must be established before the end of the second term. The committee is responsible for the comprehensive examination, the thesis proposal, and for guiding the student's research. The advisory committee must be approved by the director or associate director of the Institute. Comprehensive examinations must be taken within the first 12 months. All course requirements must be completed within the first 24

months. The student must submit a written thesis proposal and defend it in an oral examination. The expected completion time for the Ph.D. program is nine to twelve terms depending on the type of thesis and the area of research. Before the completion of the program, the student is expected to present at least two seminars in the Ottawa-Carleton Institute for Computer Science seminar series.

### Residence Requirement

Students must fulfill a residence requirement of at least four terms of full-time study.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the Summer.

The courses in the following list are offered by various departments indicated by the prefix of the course code as follows:

#### Carleton University

- 70 School of Mathematics and Statistics
- 94 Department of Systems and Computer Engineering
- 95 School of Computer Science
- 97 Department of Electronics

#### University of Ottawa

- CSI School of Information Technology and Engineering

- ELG School of Information Technology and Engineering

- MAT Department of Mathematics

#### Software Engineering

- 94.480 Software Engineering
- 94.531 (ELG6131)
- 94.571 (CSI5117)
- 94.573 (ELG6173)
- 94.578 (ELG6178)
- 94.579 (ELG6179)
- 94.586 (ELG6186)
- 95.501 (CSI5113)
- 95.502 (CSI5119)
- 95.514 (CSI5314)
- 95.516 (CSI5123)
- 95.614 (CSI7314)
- 95.663 (CSI7161)
- CSI5107 (95.569) Program Construction and Fault Tolerance
- CSI5109 (95.571) Specification Methods for Distributed Systems
- SI5111 (95.551) Software Testing: Theory and Practice
- CSI5118 (95.578) Design of Compilers and

- Translators  
 CSI5181 (95.575) Artificial Intelligence in Software Engineering  
 CSI5184 (95.584) Logic Programming  
 CSI5507(95.569) La Construction et la Tolérance aux Fautes des Programmes  
 CSI5509 (95.571) Méthodes Algébriques pour la Spécification de Systèmes Répartis  
 CSI5518(95.578) Conception des compilateurs et traducteurs  
 CSI5584 (95.584) Programmation logique

### *Theory of Computing*

- 70.482 Introduction to Mathematical Logic  
 70/95.483 Topics in Applied Logic  
 70/95.484 Design and Analysis of Algorithms  
 70/95.485 Theory of Automata  
 70/95.486 Numerical Linear Analysis  
 95.409 Introduction to Parallel and Systolic Computing  
 70.565 (MAT5165)  
 70.585 (MAT5308)  
 94.505 (ELG6105)  
 94.506  
 94.507  
 95.503 (CSI5308)  
 95.504 (CSI5305)  
 95.505 (CSI5390)  
 95.508 (CSI5164)  
 95.517 (CSI5185)  
 95.522 (CSI5172)  
 95.523 (CSI5173)  
 95.528 (CSI5167)  
 95.573 (CSI5163)  
 95/70.587 (CSI5104)  
 95.661 (CSI7160)  
 95.662 (CSI7170)  
 CSI5101 (95.561) Formal Models of Computational Systems  
 CSI5107 (95.569) Program Construction and Fault Tolerance  
 CSI5108 (95.570) Software Specification and Verification  
 CSI5110 (95.577) Principles of Formal Software Development  
 CSI5162 (95.572) Order: Its Algorithms and Graphical Data Structures  
 CSI5164 (95.508) Computational Geometry  
 CSI5165 (95.579) Combinatorial Algorithms  
 CSI5166(95.585) Applications of Combinatorial Optimization  
 CSI5174 (95.564) Validation Methods for Distributed Systems  
 CSI5507 (95.569) La Construction et la Tolérance aux Fautes de Programmes  
 CSI5508 (95.570) Spécification et Vérification

- de Logiciels  
 CSI5510 (95.577) Principes de développement formel de logiciels  
 CSI5565 (95.579) Algorithmes Combinatoires

### *Computer Applications*

- 70/95.486 Numerical Linear Algebra  
 94.405 Discrete Simulation and Its Applications  
 95.402 Computer Graphics  
 95.403 Transaction Processing Systems  
 95.407 Applied Artificial Intelligence  
 70.569 (MAT5301)  
 70.581 (MAT5303/ADM6385)  
 70.583 (MAT5304/ADM6386)  
 70.584 (MAT5307/ADM6387)  
 70.586 (MAT5180)  
 70.588 (MAT5305)  
 70.589 (MAT5306)  
 94.501 (ELG6101)  
 94.503 (ELG6103)  
 94.504 (ELG6104)  
 94.505 (ELG6105)  
 94.535 (ELG6135)  
 94.538 (ELG6138)  
 94.542 (ELG6142)  
 94.561 (ELG6161)  
 94.563 (ELG6163)  
 95.506 (CSI5306)  
 95/94.507 (CSI5307)  
 95.510 (CSI5180)  
 95.513 (CSI5313)  
 95.520 (CSI5182)  
 95.524 (CSI5124)  
 95.526 (CSI5183)  
 95.664 (CSI7162)  
 CSI5114 (95.554) Automated Office Systems  
 CSI5125 (95.517) Simulation  
 CSI5161 (95.566) Topics in System Simulation and Optimization  
 CSI5162 (95.572) Order: Its Algorithms and Graphical Data Structures  
 CSI5181 (95.575) Artificial Intelligence Applications in Software Engineering  
 CSI5304 (95.562) Knowledge Engineering  
 CSI5386 (95.555) Natural Language Processing  
 CSI5387 (95.576) Data Mining and Concept Learning  
 CSI5388 (95.581) Topics in Machine Learning  
 CSI5514 (95.554) Bureautique  
 CSI5580 (95.510) Sujet en intelligence artificielle  
 CSI5581 (95.575) Applications de l'intelligence artificielle dans le développement des systèmes



- CSI5787 (95.576) Apprentissage Symbolique  
Automatique  
ELG5162 (92.505) Knowledge-Based Systems:  
Principles and Design  
ELG5163 (92.510) Machine Vision  
ELG5196 (92.579) Automata and Neural Net  
works: Applications in  
Machine Perception  
ELG5199 (92.514) Design of Multimedia  
Distributed Database Sys-  
tems  
ELG5373 (92.515) Secure Communications  
and Data Encryption

**Computer Systems**

- 94.457 Introduction to the Archi-  
tecture of Computer  
Systems  
94.470 Introduction to Telecom-  
munications  
95.408 Performance Modelling  
94.506 (ELG6106)  
94.511 (ELG6111)  
94.519 (ELG6119)  
94.521 (ELG6121)  
94.527 (ELG6127)  
94.538 (ELG6138)  
94.558 (ELG6158)  
94.563 (ELG6163)  
94.571 (CSI5117)  
94.576 (ELG6176)  
94.577 (ELG6177)  
94.581 (ELG6181)  
94.587 (ELG6187)  
95.503 (CSI5308)  
95.509 (CSI5141)  
95.511 (CSI5311)  
95.512 (CSI5312)  
95.515 (CSI5132)  
95.517 (CSI5185)  
95.523 (CSI5173)  
95.574 (CSI5131)  
95.610 (CSI7131)  
95.662 (CSI7170)  
95.665 (CSI7163)  
97.587 (ELG6387)  
CSI5109 (95.571) Specification Methods for  
Distributed Systems  
CSI5114 (95.554) Automated Office Systems  
CSI5133 (95.568) Simulation and Testing of  
Logic Circuits

- CSI5135 (95.565) High Level Language  
Machines  
CSI5170 (95.580) Distributed Data Processing  
CSI5171 (95.583) Software for Communica-  
tion Networks  
CSI5174 (95.564) Validation Methods for  
Distributed Systems  
CSI5509 (95.571) Méthodes Algébriques pour  
la Spécification de Systems  
Répartis  
CSI5514 (95.554) Bureautique  
CSI5535 (95.565) Les machines de haut niveau  
ELG5192 (92.577) Microprocessor-based  
Systems  
ELG5193 (92.578) Multi-microprocessor  
Systems  
ELG5194 (92.573) Design and Testing of  
Reliable Digital Systems  
ELG5197 (92.512) Introduction to Embedded  
Systems  
ELG5198 (92.513) Parallel Processing with  
VLSI  
ELG5374 (92.567) Computer-Communication  
Networks  
ELG5378 (92.559) Image Processing  
Techniques and Image Com-  
munications

**Theses, Projects and Topics**

- 95.590 (CSI5140)  
95.591 (CSI5901)  
95.592 (CSI5900)  
95.593 (CSI6900)  
95.595 (CSI7999)  
95.661 (CSI7160)  
95.662 (CSI7170)  
95.663 (CSI7161)  
95.664 (CSI7162)  
95.665 (CSI7163)  
95.691 (CSI7901)  
95.692 (CSI7900)  
95.699 (CSI9999)  
CSI9998 Examen général de  
doctorat/Ph.D. Compre-  
hensive Examination

## Computer Science

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### The School

**Director of the School**, Evangelos Kranakis

**Supervisor of Graduate Studies**, D. Krizanc

The School of Computer Science offers degrees leading to a Master of Computer Science or a Ph.D. in Computer Science through the Ottawa-Carleton Institute for Computer Science. The Institute is jointly administered by the School and the Department of Computer Science at the University of Ottawa. For further information, including admission and program requirements, see p.134.

A program leading to the M.Sc. in Information and Systems Science is offered in cooperation with the School of Mathematics and Statistics and the Department of Systems and Computer Engineering. For further information see p.204.

The research expertise of the school faculty is concentrated in the following areas:

#### *Algorithms and Complexity*

Computational geometry and algebra, combinatorial optimization, distributed and parallel algorithms, multi-dimensional data structures, stochastic automata, graph theory, partial orders.

#### *Intelligent Systems*

Expert systems, knowledge acquisition tools, knowledge based assistants, connectionism and neural networks, natural language understanding, learning and adaptability, robotics, pattern recognition.

#### *Object-Oriented Systems*

Visual programming, filing systems, databases, user interfaces, simulation, animation, software engineering, office automation.

#### *Distributed Systems*

Operating systems, databases, systolic architectures, tools for performance studies, distributed programming languages, parallel computing, communication complexity, networks.

In addition to its undergraduate laboratories, the School maintains a number of state-of-the-art research laboratories all integrated via a department and campus area network.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

The complete list of courses available through the Ottawa-Carleton Institute for Computer Science is given on page 137. The following courses are offered by the School of Computer Science.

#### Computer Science 95.501F1 (CSI5113) **Foundations of Object-Oriented Programming Languages**

Object-oriented programming, design, and implementation from first principles to advanced concepts. Possible topics include: need-driven designing, metalevel programming, visual programming, event-oriented programming, web-related applications, subtyping/subclassing/isa relationships, futures and proxies, distributed applications. Prerequisite: Computer Science 95.307★ or the equivalent.

#### Computer Science 95.502W1 (CSI5119)

##### **User Interface Facilities**

This project-oriented course is concerned with the concepts, methodologies and algorithms for the specification, design and implementation of visual User Interface Facilities (UIF). The principal focus is on the software engineering of user interfaces. UIF applications in computer aided instruction, computer-aided design and visual programming are used to illustrate both general and special purpose user interfaces. Current commercial and research approaches are studied from the perspective of the user, the application designer and the systems programmer. The alternative programming metaphors of control flow, data flow, objects and constraints are introduced and their importance is discussed in the context of integrated user interface. Prerequisite: Computer Science 95.501 or the equivalent.

#### Computer Science 95.503F1 (CSI5308)

##### **Principles of Distributed Computing**

Formal models; semantics of distributed computations; theoretical issues in design of distributed algorithms; computational complexity; reducibility and equivalence of distributed problems. Related topics: systolic sys-

tems and computations, oligarchical systems and control mechanisms.

Prerequisite: Permission of the School.

Computer Science 95.504W1 (CSI5305)

### **Topics in Arithmetic Complexity**

Most scientific calculations rest on the basic arithmetic operations carried out on numbers, polynomials, and matrices. The course begins by studying the complexity of these operations. It proceeds to examine the related problem of finding the factors of an integer or polynomial, and it discusses the applications of this problem to cryptography and coding theory. The course concludes with a selection of other fundamental problems, such as polynomial evaluation, and the exploitation of parallel hardware.

Prerequisite: Computer Science 95.484★ or the equivalent.

Computer Science 95.505F1 (CSI5390)

### **Learning Systems for Random Environments**

This course will introduce students to computerized adaptive learning. Learning models in mathematical psychology will be discussed. Mathematical tools such as Markov chains and the solution of difference equations will be reviewed. The heart of the course will involve deterministic and stochastic automata, operation in random environments, norms of learning, linear and nonlinear learning schemes, convergence problems, and discretized automata with ergodic and non-ergodic properties. Applications of learning automata in file allocation, game playing, path finding, optimization and decision making will be discussed.

Prerequisite: Mathematics 70.260 or 70.350, or Engineering 94.553 or the equivalent.

Computer Science 95.506W1 (CSI5306)

### **Natural Language Understanding**

This course will introduce the students to current research in natural language processing. The emphasis of the course will be on semantic and pragmatic rather than syntactic issues and on analyzing connected discourse rather than single sentences. Several existing natural language analyzers and their applications to text analysis, CAI, knowledge acquisition, database retrieval and intelligent assistants will be described in detail. Topics will include: meaning representation; representation of pragmatic information and speech act theory; flexible parsing; determination of focus and reference; task-oriented dialog systems; dynamic memory issues. Students will be required to implement a prototype natural language analyzer.

Prerequisite: Computer Science 95.407★ or 95.501 or the equivalent.

Computer Science 94/95.507F1 (CSI5307)

### **Expert Systems**

This course will include: survey of some landmark expert systems; types of architecture and knowledge representation; inferencing techniques; approximate reasoning; truth maintenance; explanation facilities; knowledge acquisition. A project to implement a small expert system will be assigned.

Prerequisite: Computer Science 95.407★ or 95.501 or permission of the School.

Computer Science 95.508F1 (CSI5164)

### **Computational Geometry**

This course will study the design and analysis of algorithms for solving geometrical problems. These algorithms have applications in such areas as computer graphics, pattern recognition and robotics. Topics will include: visibility problems, hidden line removal, classes of polygons, testing polygons for structural properties, convex hull problems, movability of objects through a set of obstacles, point inclusion in polygons, decomposition of objects into "meaningful" components, triangulation and guard problems.

Prerequisite: Computer Science 95.384★ or the equivalent.

Computer Science 95.509F1 (CSI5141)

### **Associative Data Structures and Advanced Databases**

This course addresses concepts and advanced topics in the design, implementation and analysis of physical storage schemes with emphasis on their application to specialized database and information retrieval systems. The topics covered include associative searching techniques; multidimensional storage structures; design and analysis of algorithms for spatial data modeling; formulation and optimization of database queries; parallel hardware and distributed approaches for physical data organization and information retrieval. Some case studies of their applications to geographic information systems, object bases and multimedia databases are also discussed.

Prerequisites: Computer Science 95.305★ and 95.384★, or the equivalent.

Computer Science 95.510W1 (CSI5180)

### **Topics in Artificial Intelligence**

A programming oriented introduction to selected topics in Artificial Intelligence (A.I.). Topics for consideration include: A.I. programming techniques, pattern matching systems, natural language systems, rule based systems, constraint systems, learning systems, and cognitive systems. Assignments will be both (a) programming oriented requiring implementations and/or extensions of prototypes in Lisp and/or Prolog and (b) research ori-



ented requiring readings of special topics in current A.I. Journals.

Prerequisite: Computer Science 95.501 or the equivalent.

Computer Science 95.511F1 (CSI5311)

### **Distributed Databases and Transaction Processing Systems**

This course covers the principles involved in the design and implementation of distributed databases and distributed transaction processing systems. The topics covered include distributed computing concepts: computing networks, distributed computing environments and remote procedure call mechanisms. Distributed and multi-database system architectures and models, atomicity of distributed transaction, synchronization and distributed concurrency control algorithms, data replication, recovery techniques, and reliability in distributed databases are considered.

Prerequisites: additional credit for Computer Science 95.411★.

Prerequisites: Computer Science 95.305★, 95.401★, and 95.403★ or equivalent.

Computer Science 95.512W1 (CSI5312)

### **Distributed Operating Systems**

A course emphasizing the design issues of advanced multiprocessor distributed operating systems: multiprocessor system architectures; the process model; the object model; synchronization and message passing primitives; memory architectures and management; distributed file systems; protection and security; distributed concurrency control; deadlock and recovery; remote tasking; dynamic reconfiguration; performance measurement, modeling, and system tuning.

Prerequisite: Computer Science 95.300★ or the equivalent.

Computer Science 95.513W1 (CSI5313)

### **Computer Security and Cryptography**

Introduction to information security in computer and communication systems. Classical and public-key cryptosystems are overviewed. Applications to information schemes and digital signatures, key distribution and key agreement, authentication and secret sharing are also discussed. Also offered at the undergraduate level, with different requirements, as Computer Science 95.413★, for which additional credit is precluded.

Prerequisite: Computer Science 95.384★ or equivalent.

Computer Science 95.514W1 (CSI5314)

### **Object-Oriented Systems**

Advanced topics in current issues in object-oriented software development. Topics include the implementation of Object-Oriented languages, object-oriented software engineering models and methodologies, design pat-

terns and issues relating to large scale development such as real-time performance, persistence, concurrency, and distributed objects. Prerequisites: additional credit for Computer Science 95.414★.

Prerequisite: Computer Science 95.501 or the equivalent.

Computer Science 95.515W1 (CSI5132)

### **Parallel Processing Systems**

The aim of this course is to provide an introduction to the issues involved in designing and using parallel processing systems. Topics will be selected from the following: taxonomy and applications of parallel systems; SIMD systems; multiprocessor systems; multicompiler systems; computation versus communication issues in parallel processing; scheduling parallel systems; spinning versus blocking; interconnection networks; hot-spot contention.

Prerequisite: Permission of the School.

Computer Science 95.516W1 (CSI5123)

### **Languages for Parallel Computing**

This course will survey the major language paradigms for parallel computing: sequential imperative languages (i.e. automatically parallelizing conventional sequential languages), parallel imperative languages, functional languages (reduction and dataflow), communicating sequential processes (CSP), object and message-passing based languages, logic languages, and massive data-level parallelism. The course will cover the fundamental language issues in parallel computing systems, such as parallelism detection, determinism, data partitioning, task scheduling, task granularity, synchronization methods, resource management, and debugging for each paradigm. The course will study actual languages and systems, both past and present, and cover implementation issues as time permits.

Prerequisite: Computer Science 95.501.

Computer Science 95.517W1 (CSI5185)

### **Principles of Pattern Recognition**

Statistical pattern recognition (speech, shape, and character recognition, etc.) includes Bayes decision theory, classification criteria, maximum likelihood and Bayesian learning for parametric pattern recognition, nearest neighbour rules and discriminant function methods for non-parametric methods. Syntactic pattern recognition includes distance and probabilistic criteria for classifying strings, substrings, subsequences, and trees.

Prerequisites: Permission of the School.

Computer Science 95.520F1 or W1 (CSI5182)

### **Cerebral Computations**

Cerebral computation is concerned with computational models of the human brain. It is a programming course devoted to the design

and implementation of aspects of the brain viewed as a cerebral computer. It includes such topics as neural models, neural architectures, pre-attentional vision processing, audio and touch processing, hand-eye coordination, mental imagery, map modeling, world modeling, attentional mechanisms, associative mechanisms, affect processing, motor control, high-level planning, and models of simpler organisms. A fundamental aim is the investigation of mechanisms that exhibit plasticity and adaptability; i.e., the ability to change and improve over time.

Prerequisite: Permission of the School.

Computer Science 95.522F1 or W1 (CSI5172)

### **Network Reliability**

This course adopts a graph theoretic model of a communications network and addresses the problem of assessing the network's reliability when components are prone to failure. Topics include: graph theoretic models of computer networks, the complexity of computing reliability, combinatorial algorithms for bounding the reliability, Monte Carlo methods, and applications such as optimal facility location in unreliable networks. This course will draw on results from graph theory, complexity theory, combinatorics, and statistics.

Prerequisite: Permission of the School.

Computer Science 95.523F1 (CSI5173)

### **Data Networks**

Mathematical and practical aspects of design and analysis of communication networks. Topics include: basic concepts, layering, delay models, multiaccess communication, queuing theory, routing, fault-tolerance, as well as advanced topics on high-speed networks, ATM, mobile wireless networks, and optical networks.

Prerequisite: Computer Science 95.484★ or permission of the School.

Computer Science 95.524W1 (CSI5124)

### **Computational Aspects of Geographic Information Systems**

This course covers geographic information systems (GIS) from the computational perspective. It reviews relevant data representations and their operations on raster and vector devices: e.g., quadrees, grid files, digital elevation models, triangular irregular network models. Emphasis is on the analysis and design of efficient algorithms for solving geographic information system problems for different models. These operations are largely geometric in nature: e.g., visibility queries, point location, facility location, etc. A large component of this course is concerned with current

research in algorithmic GIS leading students to research topics and/or projects.

Prerequisite: Computer Science 95.384★ or the equivalent.

Computer Science 95.526W1 (CSI5183)

### **Genetic Algorithms and Artificial Life**

This course investigates algorithms based upon biological theories of evolution. The implementation of different forms of Genetic Algorithms (GA) and Classifier Systems are covered. Advanced topics in this area are studied including parallel and hybrid GAs, GA deception, nonbinary representation schemes and knowledge-intensive genetic operators, different reproduction strategies, and bucket brigade and temporal difference methods of credit allocation. Recent work in the field of Artificial Life is studied. Artificial Life develops computational models of theories of population behaviour, ecological interaction, and adaptation, and studies the conditions under which global behaviours emerge from many local interactions.

Prerequisite: Computer Science 95.407★ or the equivalent.

Computer Science 95.528W1 (CSI5167)

### **Complexity of Boolean Functions**

This course is intended to provide students with detailed knowledge of circuits as a model of computation for boolean functions. Circuits of interest are of polynomial size and constant or polylogarithmic depth. Topics of study include: basic boolean functions and reductions, synthesis of circuits, methods of Shannon and Lupanov, circuits for addition and multiplication, symmetric functions. Probabilistic and algebraic techniques are used for the study of constant depth circuits for symmetric functions, parity, majority, etc.

Prerequisite: Computer Science 95.384★ or the equivalent.

Computer Science 95.573F1 (CSI5163)

### **Algorithm Analysis and Design**

Topics of current interest in the analysis and design of sequential and parallel algorithms for non-numerical, algebraic and graph computations. Lower bounds on efficiency of algorithms. Complexity classes. Also offered at the undergraduate level, with different requirements, as Computer Science 95.484★, for which additional credit is precluded.

Prerequisite: Permission of the School.

Computer Science 95.574W1 (CSI5131)

### **Parallel Algorithms and Their Implementation**

Multiprocessor architectures from an application programmer's perspective: programming models, processor arrays and hypercube

## Computer Science

multiprocessors, algorithmic paradigms, efficient parallel problem solving, limits of parallelism, software scalability and portability. Student projects in selected application areas: image processing, robotics, graphics, animation, etc. Programming experience on parallel processing equipment.  
Prerequisite: Computer Science 95.484★ or the equivalent.

Computer Science 95.582W1

### **Introduction to Information and Systems Science**

An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queuing systems, optimization. (Also listed as Mathematics 70.582, Engineering 94.582, Information and Systems Science 93.582)

Computer Science 70/95.587F1 (CSI5104)

### **Formal Language and Syntax Analysis**

Computability, unsolvable and NP-hard problems. Formal languages, classes of languages, automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient parsers, LR, LR(O), LR(k), SLR, LL(k); syntax directed translation.  
Prerequisite: Computer Science 95.302«, or Mathematics 70.485« or 70.565, or the equivalent.

Computer Science 95.590F1, W1, S1 (CSI5140)

### **Selected Topics in Computer Science**

Selected topics, not covered by other graduate courses, will be offered. Details will be available at the time of registration.

Computer Science 95.591F1, W1, S1 (CSI5901)

### **Directed Studies (M.C.S.)**

A course of independent study under the supervision of a member of the School of Computer Science.

Computer Science 95.592F1, W1, S1 (CSI5900)

### **Graduate Project (M.C.S./M.Sc.(ISS))**

Computer Science 95.593F2, W2, S2 (CSI6900)

### **Intensive Graduate Project (M.C.S.)**

A one or two session course. For M.C.S. non-thesis option students only. Not to be combined for credit with 95.592.

Computer Science 95.595F, W, S (CSI7999)

### **M.C.S. Thesis**

Computer Science 70/94/95.598F, W, S

### **M.Sc. Thesis in Information and Systems Science**

Computer Science 95.610F1 (CSI7131)

### **Advanced Parallel and Systolic Algorithms**

This course is a continuation of 95.574.

Prerequisite: Computer Science 95.574.

Computer Science 95.614F1 or W1 (CSI7314)

### **Advanced Topics in Object-Oriented Systems**

Advanced object-oriented software engineering, in particular the issues of reuse and testing. Sample topics include: interaction modeling; class and cluster testing; traceability; design patterns and testing; the C++ standard template library. Students will carry out research.

Prerequisite: Computer Science 95.514 or permission of instructor.

Computer Science 95.661F1, W1, S1 (CSI7160)

### **Advanced Topics in the Theory of Computing**

Computer Science 95.662F1, W1, S1 (CSI7170)

### **Advanced Topics in Distributed Computing**

Computer Science 95.663F1, W1, S1 (CSI7161)

### **Advanced Topics in Programming Systems and Languages**

Computer Science 95.664F1, W1, S1 (CSI7162)

### **Advanced Topics in Computer Applications**

Computer Science 95.665F1, W1, S1 (CSI7163)

### **Advanced Topics in Computer Systems**

Computer Science 95.691F1, W1, S1 (CSI7901)

### **Directed Studies (Ph.D.)**

Computer Science 95.692F1, W1, S1 (CSI7900)

### **Graduate Project (Ph.D.)**

Computer Science 95.699F, W, S (CSI9999)

### **Ph.D. Thesis**



## Economics

Loeb Building C877  
Telephone: 520-3743  
Fax: 520-3906  
E-mail: economics@carleton.ca

### The Department

**Chair of the Department**, P.N. Rowe

**Supervisor of M.A. Studies**, Frances Woolley

**Supervisor of Ph.D. Studies**, R.A. Brecher

**Director of Joint Doctoral Program with the University of Ottawa**, R.A. Devlin

The Department of Economics offers programs of study and research leading to the M.A. and Ph.D. degrees.

Graduate students in economics undertake a thorough review of economic theory, together with an analysis of the Canadian economy, its institutions and history, and the working of public policy. Stress is placed on the understanding and application of quantitative methods to all aspects of economics. Although the programs are generally oriented towards policy problems, there is considerable opportunity for the development of specialized interests.

The main areas of specialization within the Department include the following:

- \* Industrial Organization
- \* Public Economics
- \* Monetary Economics
- \* International Economics
- \* Economic Development
- \* Economics of the Environment
- \* Economic Theory
- \* Quantitative Methods

### Qualifying-Year Program

Applicants who have a general (3 year) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program designed to raise their standing to honours status. If successful, they may be permitted to proceed to the master's program the following year.

Refer to the General Regulations section of this Calendar for details of the regulations governing the qualifying year.

## Master of Arts

### Admission Requirements

The normal requirement for admission to the master's program is a B.A. (Honours) (or the equivalent) in Economics, with at least high honours standing.

Applicants are expected to have had adequate preparation in microeconomic and macroeconomic theory, econometrics, and mathematics. This could be satisfied, for example, by the following four undergraduate courses: advanced microeconomic theory, advanced macroeconomic theory, econometrics, and mathematics for economists. Students with deficiencies in these requirements may have their program requirements extended accordingly.

The Department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

### Program Requirements

All master's students in economics are required to complete the following courses:

*Economics*  
43.501, 43.502, 43.505

In addition, each candidate must select and complete one of the following:

- \* Approved courses for 2.5 credits, 1.0 of which may be selected from among those offered in a related discipline, with approval of the Department, through the supervisor of M.A. Studies, *or*
  - \* A thesis equivalent to 1.5 credits and approved course(s) for 1.0 credit
- Economics 43.593 is strongly recommended.

### Academic Standing

A grade of B- or better, must normally be received in each credit counted towards the master's degree. With respect to the required credits in the program, there will be no exceptions. A candidate may, with the recommendation of the Department and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in 1.0 credit.

### Guidelines for Completion of Master's Degree

Full-time master's students are expected to complete their requirements within two terms. Part-time students will take a minimum of

five terms but must complete within an elapsed period of six calendar years, as set out in this Calendar under General Regulations (see p.63.)

### Doctor of Philosophy

The doctoral program is offered jointly by the Departments of Economics at Carleton University and the University of Ottawa.

The Ph.D program stresses the application of economic theory to the analysis of Canadian economic policy and economic development. Six areas of specialization are available for intensive study and thesis research: public economics, industrial organization, monetary economics, international economics, economic development, and economics of the environment. The program of courses and thesis guidance, drawing upon the faculty of the two Departments, will encompass course requirements, policy-oriented workshops, comprehensive examinations, and a thesis. Students are expected to have, or to acquire, proficiency in mathematics and statistics before proceeding with the program.

In cases of exceptional merit, Ph.D. candidates may be accepted on a part-time basis.

### Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree (or the equivalent) from a recognized university, with high honours standing. The Department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

### Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance, and who demonstrates high promise for advanced research during the master's program may, subject to meeting the requirements below, be permitted to transfer into the Ph.D. program without completing the M.A. program;

\* The student will have completed Economics 43.501, 43.502 and 43.505.

\* The student must make formal application to the graduate studies committee at least one month before the beginning of the term in which he/she wishes to begin the Ph.D. program.

\* Students permitted to transfer into the Ph.D. program will be required to complete the equivalent of 13.5 credits of which 6.0 or 7.0 credits will be assigned to the Ph.D. Thesis, depending on the student's background and

grades at the time of the transfer.

\* Students who have taken 43.600 and/or 43.601 as part of the M.A. curriculum will be granted advanced standing in these courses.

### Program Requirements

Students admitted to the joint Ph.D program are required to complete 1.5 compulsory credits: microeconomic theory, macroeconomic theory, and advanced econometrics.

Students are also required to do course work in two of six fields of specialization leading to field comprehensive exams and the writing of a thesis. To fulfill this requirement, students are expected to assimilate the material in 1.5 credits (or the equivalent) in each of two fields of specialization. However, the Department expects that a typical student entering the program with a completed M.A. will have taken the equivalent of 1.5 credits during his or her M.A. course work. If a student entering the program meets this expectation, the student is required to take only 1.5 credits (or the equivalent) over two fields of specialization. If the student's background is not consistent with this expectation, the admissions committee may require, as a condition of entry, that a student take up to 1.5 additional credits. Courses in the fields of specialization will be:

#### *Public Economics*

43.541, 43.542, 43.543, 43.544

#### *Industrial Organization*

43.531, 43.532, 43.533

#### *Monetary Economics*

43.566, 43.567, 43.568, 43.569

#### *International Economics*

43.561, 43.562, 43.563, 43.555

#### *Economic Development*

43.550, 43.554, 43.555

#### *Economics of the Environment*

43.535, 43.536, 43.557

### Comprehensive Examinations

Oral examinations are not compulsory, but a candidate may be required by the examining committee to sit an oral examination.

#### \* Theory

Each student will register in 43.690 (ECO7990), in preparation for the theory comprehensive examinations. There are two theory examinations, in micro-and macro-economics, to be written within twelve months of beginning full-time study.

## \* Fields

Students will be required to write comprehensive examinations in two fields.

## Thesis and Workshop Requirements

### Thesis

Doctoral students will write and defend a Ph.D. thesis. In preparing the thesis, the student is required to give two seminars in departmental workshops. In the first, a research proposal for the thesis will be presented and evaluated by three faculty members of the relevant workshop. In the second, a substantial portion of the research for the thesis will have been completed and will be presented and evaluated as above. The workshops are requirements for graduation, and students will receive 1.0 credit (or the equivalent) for them.

### Workshops

Students are encouraged to attend and participate in the regular departmental workshops relevant to their fields of interest and research. Such workshops are conducted in six areas:

- \* Industrial Organization
- \* Public Economics
- \* International Economics
- \* Monetary Economics
- \* Economic Development
- \* Economics of the Environment

Further details about this joint Ph.D. program may be obtained by writing to the Director of Doctoral Studies, joint Ph.D. program in Economics, either at the Department of Economics, Carleton University, or at the Department of Economics/ Département de science économique, University of Ottawa.

## Academic Standing

Doctoral students must normally obtain a grade of B- or better in each credit counted towards the degree.

## Guidelines for Completion of Ph.D. Degree

Full-time Ph.D. students are expected to complete their requirements within four calendar years. Students who undertake the program by a combination of full-time and part-time study must complete their degree requirements within an elapsed period of eight calendar years, as set out in this Calendar under General Regulations.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement

of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

FW,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

Enrolment in graduate courses requires the permission of the Department, through the supervisor of graduate studies.

Economics 43.501F1

### Microeconomic Theory I

An examination of the theories of the behaviour of individual economic agents: consumers and producers and their relation to the theories of price determination.

Economics 43.502F1

### Macroeconomic Theory I

Macroeconomic theory and its implications for economic policy are surveyed in this course, comparing alternative approaches for a variety of topics.

Economics 43.503W1

### Microeconomic Theory II

A continuation of Microeconomic Theory I.

Economics 43.504S1

### Macroeconomic Theory II

A continuation of Macroeconomic Theory I.

Economics 43.505F1

### Econometrics I

Estimation and testing of the general linear model, with emphasis on problems such as auto-correlation, heteroscedasticity, multicollinearity, and problems due to distributed lags and errors in variables. Introduction to simultaneous equations systems, identification, and estimation.

Economics 43.507F1, W1, S1

### Directed Readings

Prerequisite: Permission of the Department.

Economics 43.508F1, W1, S1

### Special Topics

Prerequisite: Permission of the Department.

Economics 43.509F1, W1, S1

### Directed Research

At least one paper will be required from a student enrolled in any one of these courses. Prerequisite: Permission of the Department.

Economics 43.511F1

### Canadian Economy I

An examination of aspects and problems of the Canadian economy. Topics may include the economic development of Canada, regional development, industrial organization,



## Economics

factor market, income distribution, international trade and capital flows, and macroeconomic stability.

Economics 43.512W1

### **Canadian Economy II**

Economic theory applied to the workings of the Canadian economy. Empirical estimation of various aspects of factor market operation, production, distribution, and aggregate economy. Participants are expected to prepare and present papers for discussion.

Economics 43.521F1

### **History of Economic Thought I**

The crucial achievements in economic theory and doctrine in the nineteenth and twentieth centuries are studied. Special emphasis is given to the interrelationship between the social environment and economic thought - especially to the role of economics in the development of the national state and international institutions. Also offered at the undergraduate level, with different requirements, as part of Economics 43.415, for which additional credit is precluded.

Economics 43.522W1

### **History of Economic Thought II**

A continuation of 43.521. Also offered at the undergraduate level, with different requirements, as part of Economics 43.415, for which additional credit is precluded.

Prerequisite: Economics 43.521 or permission of the Department.

Economics 43.525F1 (ECO7125; 7525)

### **Mathematical Economics**

General equilibrium; dynamic optimization; game-theory.

Economics 43.531F1 (ECO6140; 6540)

### **Firms and Markets**

An examination of theories pertaining to industrial organization, and their application to particular industries in Canada and elsewhere by way of empirical studies.

Economics 43.532W1 (ECO6141; 6541)

### **Competition Policy**

An examination of the rationale and application of competition policy with particular attention to the Canadian economy.

Economics 43.533S1 (ECO6142; 6542)

### **Regulation and Public Enterprise**

An examination of regulation and public enterprise as alternative approaches for influencing industry conduct and performance.

Economics 43.535F1 (ECO6143; 6543)

### **Economics of Natural Resources**

Dynamic optimization; theory of renewable and non-renewable natural resources, including the environment; policy options for correcting market failures.

Economics 43.536F1, W1 (ECO6151; 6551)

### **Economics of the Environment**

The environment as natural capital; environmental valuation techniques; elements of environmental income accounting; sustainable development theories and practice; institutional questions and policy issues.

Prerequisite: Economics 43.535.

Economics 43.537F1, W1

### **Labour Economics**

The application of price theory to the labour market. Topics include models of labour supply and labour demand, human capital and the economics of education and unions and their impact on the labour market. Also offered at the undergraduate level, with different requirements, as Economics 43.436★, for which additional credit is precluded.

Lectures three hours a week.

Economics 43.538W1

### **Law and Economics**

The interrelationship of law and economics, emphasizing transaction costs and property rights. Economic analysis of such topics as the allocative effects of alternative property rights, contract, tort, and nuisance law and the economics of crime, pollution, pay television, and eminent domain.

Economics 43.539W1

### **Applied Industrial Economics**

The application of industrial economics, with special emphasis on Canada and the rest of North America. Topics include the structure of consumer demand, firm production and investment, industrial structure and international trade, and the effect of government policies on industrial development.

Economics 43.541F1 (ECO6130; 6530)

### **Public Economics: Expenditure**

A discussion of the role of government expenditure, both in theory and with reference to the Canadian economy.

Economics 43.542W1 (ECO6131; 6531)

### **Public Economics: Taxation**

An analysis of the effects of various forms of taxation on economic performance.

Economics 43.543W1 (ECO6133; 6533)

### **Public Choice**

Democracy, bureaucracy, and economic policy. The public choice of fiscal constitutions, tax shares, and equity rules; voting coalitions and income distribution; the public provision of private goods; public sector size, fiscal illusion, and taxpayer revolts.

Economics 43.544W1 (ECO6132; 6532)

### **Fiscal Federalism**

This course examines the economic aspects of federalism, including efficiency, redistribi-

bution, consideration of a federal system of government, intergovernmental grants, and problems of stabilization policy in a federal context.

Economics 43.545W1

**Theoretical Welfare Economics**

A rigorous treatment of the theoretical foundations of welfare economics.

Economics 43.547W1

**Project Evaluation**

An analytical treatment of the principles of project evaluation and their applications. Also offered at the undergraduate level, with different requirements, as Economics 43.447★, for which additional credit is precluded.

Economics 43.550F1 (ECO6170; 6570)

**Theory of Economic Development**

This course will deal with theoretical approaches in the economic development literature in relation to the historical, economic, environmental, social, and political dimensions of the development process.

Economics 43.551F1

**Economic Dynamics: Cycles**

The nature and causes of fluctuations in income, prices, and employment. Topics may include simulation, forecasting, stability conditions and counter-cyclical policy. Also offered at the undergraduate level, with different requirements, as Economics 43.451★, for which additional credit is precluded.

Economics 43.552W1

**Economic Dynamics: Growth**

An examination of modern theories of economic growth. Also offered at the undergraduate level, with different requirements, as Economics 43.446★, for which additional credit is precluded.

Economics 43.553W1

**Stabilization Policy**

An examination of policies aimed at achieving internal and external stability. The implications of economic growth for stabilization policies will be discussed.

Prerequisite: Economics 43.502.

Economics 43.554W1 (ECO6171; 6571)

**Economic Development: Internal Aspects**

An analysis of major domestic problems of economic development. Topics may include employment, income distribution, choice of technology, sectoral allocation of resources, human resource development, and domestic environmental issues.

Economics 43.555F1 (ECO6172; 6572)

**Economic Development: International Aspects**

An analysis of key problems of international

economic development such as trade in primary commodities and manufactures, financial flows and debt, the role of multinational corporations, the transfer of technology, and the international dimensions of environmental issues as they relate to the developing countries.

Economics 43.557W1 (ECO6173; 6573)

**Environmental Aspects of Economic Development**

Policy aspects of sustainable economic development and environmental quality in developing countries. Topics to include energy use, deforestation, drought and desertification, depletion of natural resources, debt, environment and poverty, sustainable industrial and agricultural development, conservation policies, pollution control and global environmental issues.

Economics 43.561F1 (ECO6160; 6560)

**International Trade: Theory and Policy**

International trade theory and its implications for economic policy are examined, with emphasis on topics such as determinants of trade and specialization, gains from trade and commercial policy, international factor mobility, growth, and development.

Economics 43.562W1 (ECO6161; 6561)

**International Monetary Theory and Policy**

International monetary theory and policy, with emphasis on topics such as sources of equilibrium and disequilibrium in the balance of payments, balance-of-payments adjustment under fixed versus flexible exchange rates, international capital movements, and recent issues in the international monetary system.

Economics 43.563W1 (ECO6162; 6562)

**Topics in International Economics**

An examination of key topics in international economics, including theoretical analysis, quantitative methods and policy formulation, implementation, and evaluation.

Prerequisite: Economics 43.561 or 43.562.

Economics 43.566F1 (ECO6180; 6580)

**Microeconomic Aspects of Monetary Theory**

Microeconomic foundations of monetary theory. Alternative theories for the existence of money. Commodity, private and fiat money systems. The integration of monetary theory with the theory of value.

Economics 43.567W1 (ECO6181; 6581)

**Macroeconomic Aspects of Monetary Theory**

A course in monetary theory that deals with the macroeconomic interactions of money. Issues will include such topics as: inflation, money and wealth; the optimum quantity of

## Economics

money; the welfare aspects of monetary economics; the supply of money and its composition; stabilization policy; money, capital, and growth.

Economics 43.568F1 (ECO6182; 6582)

### Aspects of Financial Intermediation

The evolution of the financial system with special emphasis on the theory of financial institutions and its interrelationship with the money supply process and the central bank. Contemporary monetary and finance theory applied to institutional problems in both historical and contemporary settings.

Economics 43.569W1 (ECO6183; 6583)

### Explorations in Monetary Economics

A course in which explorations in theory, policy recommendations, and empirical study are undertaken. The material challenges traditional approaches by examining such topics as the endogeneity of money, the role of credit, the finance motive, the circuit approach, flow of funds analysis, and austerity policies.

Economics 43.571F1 (ECO7126; 7526)

### Econometrics II

Selected topics from estimating and testing the regression and simultaneous equation models. Topics include maximum likelihood estimation, statistical analysis of residuals, autoregressive and other time-series models, multivariate regression model, and elements of asymptotic statistical theory within the context of the simultaneous equation model.

Prerequisite: Economics 43.505 or equivalent.

Economics 43.572W1

### Applied Econometrics

A discussion of the major problems encountered in applying the tools and techniques of econometric methods to statistical data for economic analysis and forecasting. Some selected topics and papers from the applied econometric literature are critically analyzed and appraised.

Prerequisite: Economics 43.505 or the equivalent.

Economics 43.573W1

### Applied Time Series Analysis

Introduces the basic concepts of time series analysis with emphasis on models used in economics. Topics include stationary and nonstationary time series, model identification and estimation, transfer functions, and forecast computation. Also offered at the undergraduate level, with different requirements, as Economics 43.483★, for which additional credit is precluded.

Economics 43.581F1

### Regional Economics

Regional economic disparities in Canada, theories and public policy relating thereto. Con-

sideration will be given to the concept of regions, location of industry and industrial structure, and to growth determinants.

Economics 43.582W1

### Urban Economics

An examination of the economic properties of urban areas. Attention will be focused on the macrodynamics of urban development, together with the microstatics of the equilibrium properties of the urban land market.

Economics 43.586F1

### Comparative Economic Systems I

This course builds a framework for comparing economic systems, and also considers the interaction between economic and political systems. The traditional Soviet-type economy, industrial policy, and problems of transition receive particular attention. Also offered at the undergraduate level, with different requirements, as Economics 43.486★, for which additional credit is precluded.

Economics 43.587W1

### Comparative Economic Systems II

A comparison of contemporary economic systems. Such diverse economies as mainland China, Japan, Germany, Sweden, Russia, Taiwan, and Hungary may be explored. Also offered at the undergraduate level, with different requirements, as Economics 43.487★, for which additional credit is precluded.

Economics 43.593F1

### Mathematical Methods for Economists

A rigorous review of mathematical techniques in economics, such as: matrix algebra, static optimization, nonlinear programming, and difference and differential equations. It introduces the theory of optimal control, dynamic programming, and real analysis. Applications of these tools to various parts of economic theory are presented.

Economics 43.599F3, W3, S3

### M.A. Thesis

Economics 43.600W1 (ECO7922)

### Economic Theory: Microeconomics

An examination of critical aspects of microeconomic theory drawn from recent analysis of consumer behaviour, costs and production, transaction costs, uncertainty, and the organization of economic activity.

Prerequisite: Economics 43.501 or equivalent.

Economics 43.601W1 (ECO7923)

### Economic Theory: Macroeconomics

An examination of critical aspects of macroeconomic theory drawn from recent analysis of the microeconomic foundations of macroeconomics, concepts of macroeconomic equilibrium and the impact of monetary and fiscal disturbances. Attention is also



directed to a variety of topics related to the conduct of macroeconomic policy.

Prerequisite: Economics 43.502 or equivalent.

Economics 43.611F1, W1, S1 (ECO7002; 7004)

**Workshop in Economic Policy**

See requirements under Thesis and Workshop Requirements.

Economics 43.670F1, W1, S1 (ECO7980)

**Directed Readings.**

Prerequisite: Permission of the Department.

Economics 43.690W1, S1 (ECO7990)

**Ph.D. Tutorial**

Students must register in the microeconomics and macroeconomics tutorials in either the winter or spring term.

Economics 43.699F10, W10, S10 (ECO9999)

**Ph.D. Thesis**

# Ottawa-Carleton Institute for Electrical and Computer Engineering

3010 Minto CASE  
1125 Colonel By Drive  
Telephone: 520-5659  
Fax: 520-5682

Université d'Ottawa  
University of Ottawa



Carleton University

## The Institute

**Director of the Institute, Barry Syrett**

Established in 1983, the Institute combines the research strengths and resources of the Departments of Electronics and of Systems and Computer Engineering at Carleton University and the Department of Electrical Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the Institute in a wide range of fields of electrical engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor.

Registration will be at the university most appropriate to the student's program of studies and research.

Requests for information and applications for admission should be sent to the Director of the Institute.

## Members of the Institute

The home department of each member is indicated by (OE) for the Department of Electrical Engineering, University of Ottawa; (CE) for the Department of Electronics, Carleton University; (SCE) for the Department of Systems and Computer Engineering, Carleton University.

- \* T.A. Aboulnasr, *Digital Signal Processing, Applications in Communications*(OE)
- \* N.U. Ahmed, *Systems Theory, Optimal Control, Filtering and Identification with Applications to Spacecraft, Optical Networks and Artificial Hearts* (OE)
- \* Prakash Bhartia, *Microwaves, Antennas, Instrumentation*(OE - Adjunct)
- \* A.R. Boothroyd, *Solid State Devices, ICs, CAD* (CE - Adjunct)
- \* G.D. Boudreau, *Digital Communications, Efficient Coding, Spread Spectrum Communication* (OE - Adjunct)
- \* R.J.A. Buhr, *Software Design, Real-Time and Distributed Systems, Object-Oriented Design*(SCE)
- \* R.J.C. Bultitude, *Digital Radio, Propagation, Mobile and Portable Radio Systems* (SCE-Adjunct)

- \* C.H. Chan, *VLSI Circuits, Systems* (CE)
- \* J.W. Chinneck, *Computer Modelling, Operations Research, Applied Optimization*(SCE)
- \* J.-Y. Chouinard, *Mobile Communications, Wireless and Mobile Communications, Modulation and Coding, Cryptography* (OE)
- \* Jacek Chrostowski, *Photonics, Sensors*(OE - Adjunct)
- \* D.C. Coll, *Telecommunications and Computers, Image Processing*(SCE)
- \* M.A. Copeland, *ICs, Analog Signal Processing, CAD, Digital Radio* (CE - Adjunct)
- \* G.I. Costache, *Electromagnetic Interference and Compatibility*(OE)
- \* S.R. Das, *Digital Circuits, Fault-Tolerant Computing* (OE)
- \* Mike Devetsikiotis, *Modelling and Simulation, Computer Networks, Applied Optimization* (SCE)
- \* M.S. El-Tanany, *Mobile and Portable Communications, Digital Signal Processing, Synchronization* (SCE)
- \* D.D. Falconer, *Digital Communications, Signal Processing, Mobile and Portable Digital Communications*(SCE)
- \* P.A. Galko, *Digital Communications, Optical Communications*(OE)
- \* N.D. Georganas, *Multimedia Communications, Computer Communications*(OE)
- \* D.T. Gibbons, *Digital and Biomedical Electronics, Computer Engineering*(OE)
- \* R.A. Goubran, *Audio Signal Processing, Digital Systems Design, Adaptive Systems* (SCE)
- \* T.A. Gulliver, *Communications, Spread Spectrum, Digital Algebraic Coding Theory*(SCE)
- \* H.M. Hafez, *Wireless Communications, Neural Networks* (SCE)
- \* R.G. Harrison, *Microwaves, Non-linear Processes* (CE)
- \* Dan Ionescu, *Computers, Artificial Intelligence, Image Processing, Discrete Event and Real-Time Systems* (OE)
- \* G.M. Karam, *Telecommunications, Software, Analysis and Design of Concurrent Systems and Real Time Systems* (SCE - Adjunct)
- \* Ahmed Karmouch, *Multimedia Communications, Multimedia Real-Time Distributed Information Systems and Databases*(OE)

- \* Satish Kashiap, *Electromagnetic Compatibility, Electromagnetic Pulse, High Power Microwaves, Electromagnetic Analysis*(OE - Adjunct)
- \* Mohsen Kavehrad, *Digital Communications, Optical Communications and Networking, Mobile and Portable Communications*(OE)
- \* J.P. Knight, *Logic Design, Computer-Aided IC Design, VLSI Testing*(CE)
- \* Moshe Krieger, *Real-Time System Design, Microprocessor-Based Systems, Software Engineering, Computer Architecture* (OE)
- \* T.A. Kwasniewski, *Digital and Analog Signal Processing, Microprocessors*(CE)
- \* Ioannis Lambadaris, *Computer Networks*(SCE)
- \* S.A. Mahmoud, *Mobile and Portable Communication Systems, Communication Network Protocol*(SCE)
- \* Shikarish Majumdar, *Parallel and Distributed Systems, Operating Systems, Performance Evaluation*(SCE)
- \* L.S. Marshall, *Software Engineering, Software Validation and Formal Specification Tools*(SCE-Adjunct)
- \* L.R. Morris, *DSP, Microcomputers, Speech and Image Processing, Computer Architecture* (SCE)
- \* M.S. Nakhla, *Computer-Aided Engineering, Simulation and Optimization*(CE)
- \* Abdellatif Obaid, *Specification, Design and Verification of Communication Protocols*(SCE-Adjunct)
- \* L. Orozco-Barbosa, *Computer Architecture, Communication Networks and Performance Evaluation* (OE - Adjunct)
- \* Bernard Pagurek, *Network Fault Management, Artificial Intelligence, Diagnosis* (SCE)
- \* Sethuraman Panchanathan, *Computer Engineering, Video Compression, Image Processing, Parallel Processing*(OE)
- \* D.C. Petriu, *Performance Evaluation, Software Engineering, Database Systems*(SCE)
- \* E.M. Petriu, *Robotics, Sensing and Perception, Neural Networks*(OE)
- \* Calvin Plett, *Analog I.C. Design*(CE)
- \* J.S. Riordon, *Mobile Communication Systems, Distributed Databases*(SCE)
- \* J.A. Rolia, *Software Performance, Queuing Networks, Petri-Nets, Performability*(SCE)
- \* Langis Roy, *Microwave Electronics, Integrated Antennas, Electromagnetic Modelling*(OE)
- \* H.M. Schwartz, *Robotics, Controls*(SCE)
- \* A.U.H. Sheikh, *Universal Telecommunications Systems, Data Communication, Digital Signal Processing*(SCE)
- \* T.J. Smy, *Semiconductor Devices and Transducers, IC Technology*(CE)
- \* W.M. Snelgrove, *Analog Signal Processing, VLSI*(CE)
- \* W.J.D. Steenaart, *Digital Communications, Digital Signal Processing, Array Realization and Application* (OE - Adjunct)
- \* P.C. Strickland, *Antennas, Microwaves*(CE-Adjunct)
- \* M.G. Stubbs, *Microwave Integrated Circuits*(CE - Adjunct)
- \* B.A. Syrett, *Microwave Integrated Circuits, Optical Interconnects*(CE)
- \* Valek Swarc, *Signal Processing for Communications* (CE - Adjunct)
- \* N.G. Tarr, *Solid State Devices, IC Fabrication*(CE)
- \* R.E. Thomas, *Solid State Technology, Solar Energy*(CE - Adjunct)
- \* P.D. van der Puije, *Circuit Synthesis, Biomedical Engineering*(CE)
- \* D.J. Walkey, *Simulation and Modelling of Submicro MOS and Bipolar VLSI Devices*(CE)
- \* J.S. Wight, *Radar, Spread Spectrum and Navigation Systems, Microwave Circuits, Antennas, Synchronizers, Phase-Locked Circuits*(CE)
- \* C.M. Woodside, *Computer Performance, Queuing, Distributed System Design*(SCE)
- \* O.W. Yang, *Computer Communications, Broadband Networks, Performance Evaluation, Network Interconnection, Queuing Theory*(OE)
- \* Tet Yeap, *Neural Networks, Parallel Computer Architectures, VLSI, Digital Systems and Control*(OE)
- \* Abbas Yongacoglu, *Digital Communications Coding and Modulation, Spread Spectrum Systems*(OE)
- \* Q.J. Zhang, *CAD for VLSI, Optimization*(CE)

## Master's Degree

### Admission Requirements

The normal requirement for admission to a master's program is a bachelor's degree with at least high honours standing in electrical engineering or a related discipline.



## Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the departmental chair, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics). At the University of Ottawa, master's programs with a thesis earn the Master of Applied Science degree, while other master's programs earn the Master of Engineering degree. At Carleton University, all master's programs earn the Master of Engineering degree.

### *Master's Degree by Thesis*

- \* Eighteen course credits plus thesis

### *Master's Degree by Course Work*

- \* Twenty-seven course credits plus a project (nominally six credits)

### *Cooperative Master's Degree by Thesis*

- \* Eighteen course credits plus a thesis

### *Cooperative Master's Degree by Course Work*

- \* Twenty-four course credits plus two projects (each conducted in one work term)

Participation in the cooperative master's program is subject to acceptance by a suitable sponsoring organization.

## Doctor of Philosophy

### Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree with thesis in electrical engineering or a related discipline.

### Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the advisory committee, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics).

- \* A minimum of nine course credits
- \* A comprehensive examination involving written and oral examinations and a written thesis proposal, to take place before the end of the fourth term of registration
- \* A thesis which must be defended at an oral examination

## Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or advisory committee. Course descriptions may be found in the departmental section of the calendar. All courses are of one term duration. Only a selection of courses listed is given in a particular academic year. The following codes identify the department offering the course.

### *Carleton University*

- 94 Department of Systems and Computer Engineering
- 97 Department of Electronics

### *University of Ottawa*

- 92 Department of Electrical Engineering
- The CSI designation refers to the Department of Computer Science at the University of Ottawa. The ELG designation refers to the Department of Electrical Engineering at the University of Ottawa.

## Electronics

Mackenzie Building 5170  
Telephone: 520-5754  
Fax: 520-5708  
E-mail: gradinfo@doe.carleton.ca

### The Department

**Chair of the Department, J.S. Wight**

**Associate Chair, Graduate Studies, D.J. Walkey**

In addition to University and Graduate Faculty regulations, all Engineering departments share common procedures that are described in Section 18 of the General Regulations (see p. 66).

Programs of study and research leading to the master's and Ph.D. degrees in electrical engineering are offered through the Ottawa-Carleton Institute for Electrical and Computer Engineering. The Institute, established in 1983, combines the resources of Carleton University and the University of Ottawa. For further information, including admission and program requirements, see p. 152.

The Department of Electronics is concerned with the fields of applied and physical electronics. Effort is strongest in four broad areas: computer-aided design for electronic circuits; physics and fabrication technology for solid-state electronic and photonic devices; VLSI and high-speed analog integrated circuits; and microwave and photonic subsystems and circuits. Specific areas of specialization include:

#### *Computer-Aided Circuit Design*

Development of hierarchical simulators for mixed analog/digital circuits; analysis and design of switched-capacitor networks; analysis and design of high speed circuits; optimization techniques; synthesis of VLSI circuits using both algorithmic and knowledge-based approaches; analysis and simulations of communications systems links; layout synthesis and module generation.

#### *Photonic Devices*

Waveguides and holographic optical elements for optical interconnects; electro-optic modulators and switches; waveguides for sensing applications.

#### *Solid State Devices*

Fundamental semiconductor device physics; device design and novel device structures; device modelling for CAD; new fabrication processes; submicron and quantum effect devices; photovoltaics; semiconductor sensors and transducers.

#### *Integrated Circuit Engineering*

Design and development of linear and digital integrated circuits; fabrication processes and test techniques; MOS, bipolar and BiCMOS ICs; VLSI; computer-aided circuit design.

#### *Analog Signal Processing*

Switched-capacitor filters, transversal filters, operational amplifiers and radio frequency functions in analog signal processing applications, particularly for integrated circuit realization.

#### *Circuits*

Active filters; linear and nonlinear circuit design; computer-aided circuit design; phase-locked circuits, carriers and clock synchronizers; mixers, modulators and demodulators.

#### *Microwave Electronics*

Microwave amplifiers, oscillators, modulators, frequency converters, phase-shifters; use of FET and bipolar transistors, Schottky barrier, varactor, step recovery and PIN diodes; design using finline, microstrip, stripline, coax, and waveguide; monolithic microwave ICs in GaAs; miniature hybrid microwave ICs.

#### *Communications and Radar Electronics*

Circuits for terrestrial and satellite communications; circuit implementation of digital modulation techniques; antenna and array design; communication channel characterization; optical communications circuits; radar transmitter and receiver design.

#### *Biomedical Electronics*

Cochlear prosthesis.

### NSERC/BNR Chair in CAD

The joint Natural Sciences and Engineering Research Council/Bell Northern Research Chairs in Computer-Aided Design are currently held by Dr. Michel Nakhla and Dr. Q.J. Zhang. This is part of a planned expansion of the department in the area of CAD for VLSI.

### CITO

The Department is part of the CITO (Communications and Information Technology of Ontario) Centre of Excellence. Current research areas of the Centre with major participation from the Department are: integrated services digital networks, mobile and portable wireless networks, VLSI in communications, and millimetre wave/optical antennas and circuits for personal communications.

### Micronet

The Department is a member, along with seven other Canadian universities and several major

industrial organizations, of Micronet, the federally-sponsored network on Microelectronic Devices, Circuits and Systems for ULSI (ultra-large scale integration). Within the Department Micronet supports research on: device structures, modelling and fabrication processes for submicron CMOS and BiCMOS ICs; high-speed filters, phase detectors, A-to-D converters, frequency synthesizers and other circuit elements for silicon ICs operating at radio frequencies; analysis and optimization of interconnects for high-speed ICs; and automated generation of custom cells for VLSI design.

### Course Offerings

The structure of the courses offered allows a well-integrated master's or Ph.D. program of study to be chosen that is appropriately related to the field of thesis research. Device- and integrated-circuit-oriented courses cover: fabrication, semiconductor device theory, semiconductor device design, integrated circuit design, and integrated circuit reliability. Circuit-oriented courses include: signal-processing electronics, micro-processor electronics, computer-aided circuit design, phase-locked circuits, filter circuits, RF and microwave circuits, antenna and array design. Systems-oriented courses cover: optical fibre communications and radar systems.

### IC Fabrication Facilities

Excellent facilities are available for the fabrication of solid state devices and integrated circuits for research purposes. These include a class-100 clean room in which all basic processes required in silicon monolithic technology can be carried out. The clean room houses facilities for photomask generation and photolithography, modern diffusion furnaces, a rapid thermal annealer, low-pressure chemical vapour deposition systems, ECR and reactive ion etchers, e-beam, RF and magnetron sputtering systems for metal deposition, and a SEM. Equipment for thick film deposition, scribing, bonding, and automatic testing is also available. Comprehensive test facilities are available for IC characterization, including wafer probers, HP4145 Semiconductor Parameter Analyzers, and an automated C-V measurement station.

### Computing Facilities

The Department has excellent computing facilities for software development and circuit design for integrated circuits and microwave circuits. IC designs using synthesis, standard cells and layout are supported for fabrication through the Canadian Microelectronics Corporation or in-house.

The graduate computer network consists of 90 SUN workstations and has access to the Internet. Industry standard software includes CADENCE, Mentor Graphics, SYNOPSYS, HSpice, ANACAD, VARILOG, SONNET, EESOF, SUPREM, SEDAN, MEDICI, MINIMOS, Franz COMMON Lisp, MATLAB, MATHEMATICA, FRAMEMAKER, and others.

### Measurement Facilities

Advanced instrumentation is available supporting automated testing of both analog and digital integrated circuits at frequencies up to 2 GHz. Low noise test facilities include a phase noise measurement system, dynamic signal analyzers, spectrum analyzers, network analyzers, arbitrary waveform generators, digital sampling oscilloscopes, digital data analyzers and generators, and RF frequency synthesizers, all of which may be controlled using the IEEE 488 interface.

The Department has up-to-date facilities for circuit development and measurement at microwave frequencies ranging up to 22 GHz. There are also facilities for work at optical frequencies. Thin-film microwave integrated circuits can be fabricated in-house; there is provision for the fabrication of GaAs MMICs through foundry services. Special purpose microwave equipment includes automated network analyzers, spectrum analyzers and frequency synthesizers, and a complete microwave link analyzer. Data generators and error-detection equipment is available for work on digital communications. Industry standard software, such as SERENADE (SUPERCOMPACT, HARMONICA) and ACADEMY (TOUCHSTONE, LIBRA) is available for the computer-aided design and layout of microwave integrated circuits.

The research laboratories maintain extensive collaboration with government and industrial research and development agencies in the Ottawa area.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.



The courses offered by the Department of Electronics are as follows:

**Engineering 97.551F1 (ELG6351)**

**Passive Microwave Circuits**

Propagation in ferrites. Characteristics of planar transmission lines, stripline, micro-strip, coplanar lines, slotlines. Representation of discontinuities in transmission lines and waveguides. Scattering-matrix characterization of microwave junctions and discontinuities. Microwave network analysis. Design theory (including CAD), characteristics, and use of microwave components.

**Engineering 97.552F1 or W1 (ELG6352)**

**Analog Integrated Filters**

The fundamentals and details of analog continuous-time and SAW filters. Comparison to switched-capacitor filters. Review of filter concepts, types of filters, approximations, transformations. Building blocks such as op amps, transconductance amplifiers, and gyrators. Design using cascaded second-order sections, multiple loop feedback and LC ladder simulations.

**Engineering 97.553 (ELG6353)**

**Radio Frequency Integrated Circuit Design**

Integrated radio front-end component design. Overview of radio systems, frequency response, gain, noise, linearity, intermodulation, image rejection, impedance matching, stability, and power dissipation. Detailed design of low-noise amplifiers, mixers, oscillators and power amplifiers. Use of on-chip inductors and baluns. Process variations, parasitics, and packaging.

**Engineering 97.554F1 or W1 (ELG6354)**

**Analysis of High-Speed Electronic Packages and Interconnects**

Introduction to modelling, simulation and optimization of high-speed VLSI packages; models for packages, interconnects and ground/power planes; lumped, distributed and EM models for interconnects; delay, crosstalk and switching noise; moment matching techniques; concurrent thermal/electrical analysis of IC packages and boards.

**Engineering 97.555F1 (ELG6355)**

**Passive Circuit Theory**

General description of networks leading to matrix representations. Elements of matrix algebra as applied to networks. Properties of network functions; poles and zeros of driving point and transfer functions. Foster and Cauer canonic forms. Synthesis of lossless two-ports, single and double-terminated.

**Engineering 97.556W1 (ELG6356)**

**Simulation and Optimization of Electronic Circuits**

Introduction to computer simulation and optimization of electrical circuits. Time- and frequency-domain formulations for sensitivity analysis and optimization. Optimization techniques for performance-, cost- and yield-driven design of electronic circuits. Optimization approaches to modelling and parameter extraction of active and passive elements.

**Engineering 97.557W1 (ELG6357)**

**Active Circuit Theory**

Characterization of negative resistance one-port networks, signal generation and amplification. Active two-ports;  $y$ ,  $z$ ,  $h$ ,  $k$ , chain and scattering parameters. Measurement of two-port parameters. Activity and passivity; reciprocity, non-reciprocity, and anti-reciprocity. Stability, inherent and conditional; power gain of conjugate and mismatched two-port amplifiers.

Prerequisite: Engineering 97.555 or equivalent.

**Engineering 97.558F1 (ELG6358)**

**Computer Methods for Analysis and Design of VLSI Circuits**

Formulation of circuit equations. Sparse matrix techniques. Frequency and time-domain solutions. Relaxation techniques and timing analysis. Noise and distortion analysis. Transmission line effects. Interconnect analysis and crosstalk simulation. Numerical inversion techniques. Asymptotic waveform estimation. Mixed frequency/time domain techniques. Sensitivity analysis.

**Engineering 97.559F1 (ELG6359)**

**Integrated Circuit Technology**

Survey of technology used in silicon VLSI integrated circuit fabrication. Crystal growth and crystal defects, oxidation, diffusion, ion implantation and annealing, gettering, CVD, etching, materials for metallization and contacting, and photolithography. Structures and fabrication techniques required for submicron MOSFETs. Applications in advanced CMOS processes.

**Engineering 97.560F1 or W1 (ELG6360)**

**Digital Integrated Circuit Testing**

Production testing of digital integrated circuits. Outline of methods of testing used in production. Testing schemes and design for testability. Faults and fault models, yield estimates, testability measures, fault simulation, test generation methods, sequential testing, scan design, boundary scan, built-in self test, CMOS testing.

Engineering 97.562W1 (ELG6362)

**Microwave Semiconductor Devices and Applications**

Characteristics of varactor, p-I-n, Gunn and IMPATT diodes. Characteristics and small-signal models of silicon, GaAs and SiGe BJTs; GaAs MESFET and HEMT. Large-signal GaAs MESFET model. Design of transistor amplifiers and oscillators. Discussion of device/circuit fabrication technology with emphasis on monolithic microwave integrated circuits (MMICs).

Engineering 97.563W1 (ELG6363)

**Electromagnetic Wave Propagation**

Review of groundwave, skywave and transionospheric propagation modes relevant to radar, communications and other systems operating in the medium to extra high frequency bands. Electromagnetic noise: physical principles involved, modelling and prediction techniques, and limitations of such techniques in practical situations.

Engineering 97.564W1 (ELG6364)

**Radar Systems**

Fundamentals; range equation, minimum detectable signal, radar cross-section, pulse repetition frequency, range ambiguities. Radar classes: CW, FM-CW, MTI, tracking, air surveillance, SSR, PAR, MLS, SAR, SLAR, OTH, 3D and bistatic radars. Radar subsystems; transmitters, antennas, receivers, processors, displays, detection criteria; CFAR receivers, noise, clutter precipitation.

Engineering 97.565F1 (ELG6365)

**Optical Fibre Communications**

Transmission characteristics of and design considerations for multi-mode and single-mode optical fibre waveguides; materials, structures, and device properties of laser light sources; properties and performance of p-i-n and avalanche photodiodes; types of optical fibre signal formats, preamplifier topologies, noise, receiver sensitivity, transmitter design, link design.

Engineering 97.566F1 (ELG6366)

**Phase-Locked Loops and Receiver Synchronizers**

Phase-locked loops; components, fundamentals, stability, transient response, sinusoidal operation, noise performance, tracking, acquisition and optimization. Receiver synchronizers: carrier synchronizers including squaring loop, Costas loop, and remodulator for BPSK, QPSK BER performance; clock synchronizers including early-late gate, in-phase/midphase, and delay line multiplier.

Engineering 97.567F1 (ELG6367)

**Antennas and Arrays**

Design projects are interspersed with live and video lectures. Lectures cover definitions, wire structures, mutual coupling, method-of-moments, array theory, photonic devices, frequency independent structures, reflectors, horns, feeds, slotted waveguide and microstrip arrays. Design projects include a printed dipole, yagi and series-fed microstrip patch array.

Engineering 97.568W1 (ELG6368)

**Fourier Optics**

The theory and applications of diffractive and non-diffractive coherent optics, with emphasis on holograms, tomography and high-speed optical computing. Mathematical basis: generalized 2-D Fourier transforms, transfer function of an optical system, 2-D sampling theory, Helmholtz equation, Green's theorem, and the classical diffraction theories.

Engineering 97.569W1 (ELG6369)

**Nonlinear Microwave Devices and Effects**

The physical basis and mathematical modelling of a variety of microwave/millimeter-wave devices, (some of which exhibit the most extreme nonlinear behaviour known), how they can be exploited in practical circuits and systems, and how the resulting device/circuit interactions can be analyzed.

Engineering 97.572F1 (ELG6372)

**Optical Electronics**

Electromagnetic wave propagation in crystals; review of geometric optics; Gaussian beam propagation; optical fibres; dielectric waveguides for optical integrated circuits; optical resonators; optical properties of materials; theory of laser oscillation; specific laser systems; electro-optic modulators; photorefractive materials and applications; holography; optical interconnects.

Engineering 97.573F1 or W1 (ELG6373)

**Advanced Topics in Solid State Devices and ICTechnology**

Recent and advanced topics in semiconductor device physics, modelling, and integrated circuit fabrication technology. Topic varies from year to year according to departmental research interests. Students may be expected to contribute lectures or seminars on selected topics.

Engineering 97.574F1 or W1 (ELG6374)

**Advanced Topics in CAD**

Recent and advanced topics in computer-aided techniques for the design of VLSI and telecommunications circuits. Topics will vary from year to year according to the depart-

mental research interests. Students may be expected to contribute lectures or seminars on selected topics.

Engineering 97.575F1 or W1 (ELG6375)

#### **Advanced Topics in VLSI**

Recent and advanced topics in the design of very large scale integrated circuits, with emphasis on mixed analog/digital circuits for telecommunications applications. Topic varies from year to year according to departmental research interests. Students may be expected to contribute lectures or seminars on selected topics.

Engineering 97.576F1 or W1 (ELG6376)

#### **Submicron CMOS and BiCMOS Circuits for Sampled Data Applications**

The analog aspects of digital CMOS and BiCMOS circuit design in submicron technologies including reliability; sampled analog circuits, including amplifier non-ideal characteristics and switch charge injection; CMOS/BiCMOS amplifier design considerations, leading up to standard folded-cascode and two-stage circuits.

Engineering 97.577W1 (ELG6377)

#### **Microelectronic Sensors**

Fabrication and physical principles of operation of microelectronic sensors. A large variety of sensors will be studied and the basic fabrication methods used in their production reviewed. The devices discussed will include optical sensors, fibre optic sensors, magnetic sensors, temperature sensors and, briefly, chemical sensors.

Engineering 97.578F1 (ELG6378)

#### **ASICs in Telecommunications**

Modern ASIC technologies for Telecom will be introduced. Circuit level building blocks for typical wireline and wireless applications will be overviewed. Both analog and digital circuits will be considered. A topical literature study, circuit level design exercises and take home final exam will be required.

Engineering 97.579W1 (ELG6379)

#### **Advanced Topics in Electromagnetics**

Recent and advanced topics in electromagnetics, antennas, radar systems, microwave devices and circuits, or optoelectronics. The subject material will vary from year to year according to research interests in the department and/or expertise provided by visiting scholars or sessional lecturers.

Engineering 97.580F1 (ELG6380)

#### **Theory of Semiconductor Devices**

Equilibrium and non-equilibrium conditions in a semiconductor. Carrier transport theory. Physical theory of basic semiconductor device structures and aspects of design: PN junctions and bipolar transistors, field effect devices.

Current transport relationships for transistors. Charge control theory. Modelling of device mechanisms. Performance limitations of transistors.

Engineering 97.582W1 (ELG6382)

#### **Surface-Controlled Semiconductor Devices**

Fundamentals of the MOS system; MOS capacitors. Long channel behaviour: theory, limitations and performance of the SPICE level 1 and 2 models. Small geometry effects. Sub-threshold operation and modelling. Hot electron effects and reliability.

Engineering 97.583F1 (ELG6383)

#### **Silicon Compilers: Automated IC Synthesis**

Various topics related to computer analysis and synthesis of integrated circuits including automatic programmable logic array/finite state machines compilers, silicon compilers and automatic test plan generators.

Prerequisite: Some IC design knowledge as given, for example, by Engineering 97.469.

Engineering 97.584F1 (ELG6384)

#### **VLSI Design**

An IC design course with a strong emphasis on design methodology, to be followed by 97.585 in the second term. The design philosophies considered will include Full Custom design, standard cells, gate-arrays and sea-of-gates using CMOS and BiCMOS technology. State-of-the-art computer-aided design tools are used.

Engineering 97.585W1 (ELG6385)

#### **VLSI Design Project**

Using state-of-the-art CMOS and BiCMOS technologies, students will initiate their own design of an integrated circuit using tools in the CAD lab and submit it for fabrication where the design warrants.

Engineering 97.588F1 (ELG6388)

#### **Signal Processing Electronics**

CCDs, transversal filters, recursive filters, switched capacitor filters, with particular emphasis on integration of analog signal processing techniques in monolithic MOS ICs. Detailed on amp design in CMOS technology. Implications of nonideal op amp behaviour in filter performance. Basic sampled data concepts.

Engineering 97.590F1, W1, S1

#### **Engineering Project I**

A one-term course, carrying 0.5 credit, for students pursuing the course work M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Written and oral reports are required. This course may be repeated for credit.



## **Electronics**

Engineering 97.591F2, W2, S2

### **Engineering Project II**

A one-term course, carrying full-course credit, for students pursuing the course work or co-op M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Written and oral reports are required. This course may be repeated for credit.

Engineering 97.596F1, W1, S1

### **Directed Studies**

Various possibilities exist for pursuing directed studies on topics approved by a course supervisor, including the above listed course topics where they are not offered on a formal basis.

Engineering 97.599F4, W4, S4

### **M.Eng. Thesis**

Engineering 97.699F, W, S

### **Ph.D. Thesis**

## Electrical Engineering (University of Ottawa)

University of Ottawa  
161 Louis Pasteur  
Colonel By Hall  
Telephone: 564-8213  
Fax: 564-6882  
E-mail: gradinfo@trix.genie.uottawa.ca

### The Department

Chair of the Department, G.I. Costache

Graduate Program Coordinator,  
Sethuraman Panchanathan

The Department of Electrical Engineering is one constituent of the Ottawa-Carleton Institute for Electrical and Computer Engineering. Consult the Institute entry beginning on page of this calendar for a faculty list, graduate program descriptions, and admission requirements.

### Department Facilities

#### Computing Facilities

- (i) A UNIX network consisting of:
  - (a) Two RISC DecServer 3100s each with 24 MB of RAM and a 1 GB disk
  - (b) Four RISC DecStation 3100s each with 16 MB of RAM, a 100 MB disk and a 19" colour monitor
  - (c) Five RISC DecStation 3100s each with 16 MB of RAM, a 100 MB disk and a 19" monochrome monitor
- (ii) Several other Unix-based workstations in various research laboratories (SUN workstations, Compaq 386, HP386, etc.)

In addition to this, the Department operates dozens of IBM compatible and Apple Macintosh family computers. All of the department's computers are linked together using Ethernet and LocalTalk networks. The department's networks connect to the University of Ottawa's mainframe and the Internet network. The Department is also linked to OCRInet, Canada's first ATM research network, which provides high speed links for various projects (primarily in the Multimedia Communications Research Laboratory) to such industry and government collaborators in the Ottawa region as Nortel, Newbridge Networks, Telesat Canada, Stentor, Bell Canada, the Communications Research Centre, and the National Research Council.

Graduate students have access to a RS6000/390 operated by the University of Ottawa's Computer Services for research in Engineer-

ing. This UNIX machine is equipped with such software packages as MATLAB, Mathematica, Maple, IMSL, Explorer, MiniTab, SAS, etc.

In addition to these facilities, students in the Department have access to a computer-aided design laboratory operated by the Faculty of Engineering (University of Ottawa). This facility includes 24 networked Silicon Graphics workstations; it is, however, intended primarily for the use of undergraduate students.

#### Digital Communications Research Laboratory

This laboratory is equipped with a variety of communication system and signal analysis equipment. This includes some of the latest equipment for data source simulation, data error rate monitoring, spectrum analysis, cross and autocorrelation function measurement, probability density function measurement, noise simulation, filtering, etc. It also includes prototype digital modulation and demodulation equipment, and various digital signal processing hardware and software systems based on the TMS320C25 digital signal processor. The laboratory also features a 14/12 GHz satellite earth station and associated terminal equipment for testing prototype equipment on an actual satellite link.

#### Lightwave Communications Research Laboratory

This laboratory is equipped with many modern optical communications instruments covering wavelengths in the range of 600nm to 1500nm. The laboratory also has several UNIX workstations, and Macintosh and PC computers interconnected on the department's networks. The computing facilities are equipped with software packages used for computer simulation of various aspects of optical communication systems and networks. The laboratory is also equipped with audio-video equipment for image communication over fibre networks and two bench-top fibre local area networks that use WDM and/or CDM on the physical layer.

#### Multimedia Communications Research Laboratory

This laboratory is equipped with more than 20 SUN Sparc20, Sparc10, Silicon Graphics Indy, IBM RS/6000 and DEC Alpha workstations, a variety of PC-UNIX hosts, and Macintosh computers. While UNIX (Solaris, SCO OTD, AIX, Linux) is the predominant operating system

used in the laboratory, Apple System 7 and Windows NT are also available. Software tools available include various C and C++ compilers, ObjectSore OODBMS and a variety of multimedia authoring and programing toolkits. The laboratory is also equipped with video cameras, video display/capture boards, audio input/output devices, etc. These resources are complemented with a heterogeneous network consisting of 10 Mbps Ethernet, 16 Mbps Token Ring, 100 Mbps FDDI and 155 Mbps ATM. The laboratory is connected, via OCRI net, to industry and government collaborators in the Ottawa region.

### **Electromagnetic Research Laboratory**

This laboratory is equipped with modern coaxial line and waveguide instruments covering frequencies from 10 MHz to 60 GHz. A computer-controlled frequency domain network analyzer with error correcting capabilities allows reflection and transmission measurements from 5 Hz to 60 GHz. The laboratory is also equipped with a computer-controlled time domain network analyzer and a modern scalar network analyzer (transmission, reflection test set) as well as various frequency counters and spectrum analyzers. A computer controlled three-dimensional scanning system is located in an anechoic chamber and may be used for near-field antenna measurement in both frequency and time domains over the frequency range from 100 MHz to 3GHz. TEM cells at 100 MHz and 3 GHz are available for field probe calibration and EMC/I testing of electronic equipment.

### **Graduate Courses**

Engineering 92.505 (ELG5162)

#### **Knowledge-Based Systems: Principles and Design**

Basic concepts and terminology. Introduction to mathematical logic and to reasoning. Introduction to Lisp and Objective C. Knowledge representation using rules, semantic nets and frames. Case study. Representation in state space. Case study. Use of knowledge. Procedural and declarative knowledge. Demons. Production systems. Case study. Solution searching algorithms. Expert system components. Inference engine principle. Basic schemes for inference engine representation. Knowledge-based system design. Using an expert system shell for the design of knowledge-based systems. Case study: an expert system for process control.

Engineering 92.506 (ELG7132)

#### **Topics in Electronics I**

Current topics in the field.

Engineering 92.507 (ELG7133)

#### **Topics in Electronics II**

Current topics in the field.

Engineering 92.508 (ELG7575)

#### **Sujets choisis en électronique**

Sujets d'intérêt courant dans la matière.

Engineering 92.510 (ELG5163)

#### **Machine Vision**

Image acquisition. Lighting considerations. Structured light and stereo ranging. Gray-scale and binary images: geometric and topological properties. Regions and image segmentation. Image preprocessing. Edge finding. Image processing. Image recognition techniques. Mathematical models for image representation. Mathematical morphology. Model building. Representation of 3-D objects. Three dimensional scene understanding. Motion detection. Special vision architectures, massively parallel computers, AIS series. Machine vision for manufacturing.

Prerequisite: ELG4153.

Engineering 92.511 (ELG7199)

#### **Directed Studies**

Various possibilities exist for pursuing directed studies on topics approved by the Department and which a full-time faculty member has agreed to direct, including any of the courses listed in the Graduate Calendar that are not being offered on a formal basis in the current academic year.

Engineering 92.512 (ELG5197)

#### **Introduction to Embedded Systems**

Embedded systems; general characteristics, their niche, and design alternatives. Simple embedded systems: sequential event response systems and cyclic executives. Design overview: prototype-based designs, multitasking and multiactivity paradigms. Multitasking system design: elements of real-time operating systems and harmony. Multiactivity systems design: process activity language (PAL) and PAL based design tools.

Prerequisite: ELG4161 or the equivalent.

Engineering 92.513 (ELG5198)

#### **Parallel Processing with VLSI**

Overview of parallel processing. Architectures for parallel processing: array processors, associate processors, vector processors, orthogonal processors, switch lattice architecture, hypercubes, systolic arrays, wavefront arrays, pyramid structures, data flow architectures, and reduction machines. Memory organization, buses, I/O and interconnection networks for parallel processing systems. Connection machine processing hardware, RISC processors, and some VLSI processors. Impact of GaAs technology on parallel processing. Future parallel processing systems implementa



tions. Some representative parallel processing systems. Examples of parallel processing architectures for various applications.

Engineering 92.514 (ELG5199)

### **Design of Multimedia Distributed Database Systems**

Conventional database technology trends. Database concepts and architecture. Data modelling. Relational technology and distributed databases: relational concepts, relational algebra, distributed database architecture, horizontal and vertical fragmentations, distribution design, distributed transparency and distributed concurrency control. Examples of the new generation of databases for advanced applications such as multimedia information retrieval and the limitations of the conventional models for managing multimedia information (graphics, text, image, audio/video and voice). Extended relational databases and object-oriented database approaches will be discussed.

Engineering 92.515 (ELG5373)

### **Secure Communications and Data Encryption**

Introduction to secure communications. Data encryption and encipherment. Source entropy and average mutual information. Cryptanalysis of encrypted data. Classic encipherment methods: substitution, transposition and product ciphers. Symmetric cryptosystems: shift register sequences, stream ciphers and Data Encryption Standard DES. Public key encipherment concept, RSA cipher, knapsack cipher, computational complexity, Diffie-Hellman public key distribution scheme. Message authentication and identity verification. Applications: electronic funds transfer, secure speech communications.

Prerequisite: ELG5119 or 94.553 or the equivalent.

Engineering 92.516 (ELG5113)

### **Stochastic Systems**

Wiener processes. Poisson random measures. Stochastic Wiener-Ito integrals. Stochastic integrals with respect to Poisson measures. Stochastic differentials. Diffusion processes. Ito-stochastic differential equations: existence and uniqueness of solutions, continuous dependence of solutions with respect to parameters. Semigroup theory and generation of semigroups as applied to stochastic differential equations. Applications to engineering systems modelling (computer communications networks, power system networks, etc.).

Prerequisite: Permission of the instructor.

Engineering 92.517 (ELG5164)

### **Fuzzy Systems**

Fuzzy and neural machine intelligence. Fuzziness versus probability. Fuzzy associa-

tive memories. Fuzzy control systems. Comparison of fuzzy and neural systems. Comparison of fuzzy and Kalman-filter systems. Fuzzy neural networks. Applications of the fuzzy logic in control, robotics and machine perception.

Engineering 92.518 (ELG5381)

### **Switching and Traffic Theory for Integrated Broadband Networks**

Principles of switching theory. Circuit switching and fast packet switching. Self routing and non-blocking switches. Asynchronous Transfer Mode switching architectures. Principle of teletraffic engineering. Queuing theory topics and performance evaluation techniques as applied to the study of computer network architectures. Current topics in integrated services computer network modelling analysis, such as congestion control for high-speed networks, frame relaying services and integration of services.

Prerequisite: ELG5374 (92.567) or ELG 6121 (94.521) or the equivalent. Corequisite: ELG5119 (92.519) or ELG6153 (94.553) or ELG6103 (94.503) or the equivalent.

Engineering 92.519 (ELG5119)

### **Stochastic Processes**

Probability spaces. Random variables. Distribution and density functions. Expectation. Functions of random variables. Moments and characteristic functions. Random vectors. Functions of random vectors. Sequences of random variables. Convergence notions. The central limit theorem. The law of large numbers. Stochastic processes: basic notions, characterizations and examples. Stationarity notions. Poisson processes. Gaussian processes. Transformations of stochastic processes. Ergodicity. Second order random processes. Representation theorems. Markov processes. Homogeneous Markov chains. Applications. Precludes additional credit for Engineering 94.553.

Engineering 92.520 (ELG5120)

### **Queuing Systems**

Resource sharing issues such as delay, throughput and mean queue length. Basic queuing theory, Markov chains, birth and death processes.  $M/M/k/n$  queues, bulk arrival/service systems. Little's Rule. Intermediate queuing theory:  $M/G/1$ ,  $G/M/m$  queues. Advanced queuing theory:  $G/G_m$  queue, priority queue, fluid approximations, network of queues, etc. Application of various queuing systems.

Prerequisite: One of ELG5119, 94.503 or 94.553 or the equivalent. Precludes additional credit for Engineering 94.517

Engineering 92.522 (ELG5122)

**Modelling, Analysis and Performance Evaluation in Computer Communications**

Performance issues. Mathematical analysis techniques: the intermittently available server model, probing and tree search techniques, delay cycle and cycle time analysis, switch/network topology and reliability. Applications in controlled and random access methods, routing allocation and control, topological design problems. Selected topics from current literature.

Precludes additional credit for ELG7186 (92.566).

Prerequisites: ELG5120 (92.520), ELG5374 (92.567) or 94.521 (ELG6121); or the equivalent.

Engineering 92.523 (ELG5191)

**Design of Distributed System Software**

Design and programming issues, OO technology for distributed computing RPC, CORBA, Java, DCE, DCOM, TINADPE. Characterization through OO models. Distributed client server design. Scalability, interoperability, portability and CORBA services. CASE tools for distributed applications. Example distributed application design: xbind amp platform for ATM multimedia.

Precludes additional credit for ELG7186 (92.587) (if taken in 1997-98).

Prerequisites: an undergraduate degree in Computer Engineering, or Computer Science, or practical experience in system software design.

Engineering 92.527 (ELG5161)

**Robotics: Control, Sensing and Intelligence**

Robotics as the intelligent connection of perception to action. Robotics in the CIM context. Advanced robotics technologies. Robot arm kinematics and dynamics. Planning of manipulator trajectories. Control of robot manipulators. Robot-level programming. Sensors and sensory perception. Control problems for sensory controlled robotic-based flexible manufacturing systems. Task-level programming. Mobile robots. Knowledge-based control for mobile robots: environment perception, robot's world model, navigation and motion control.

Prerequisite: ELG4161 or the equivalent.

Engineering 92.529 (ELG7113)

**Topics in Systems and Control I**

Current topics in the field, including linear semigroup theory and optimal feedback control.

Engineering 92.530 (ELG7114)

**Topics in Systems and Control II**

Current topics in the field, including linear and non-linear filtering and optimal control of stochastic systems.

Engineering 92.531 (ELG7574)

**Sujets choisis en systèmes et réglage automatique.**

Sujets d'intérêt courant dans le domaine.

Engineering 92.535 (ELG5108)

**Electromagnetic Compatibility and Interference**

Interference phenomena. Shielding of conductors. Grounding. Other noise reduction techniques. EMI filters. Noise sources: narrowband and broadband. Electromagnetic pulse as an interference source. Modelling EMI/C circuit boards and backplanes.

Prerequisite: ELG4103 or the equivalent.

Engineering 92.538 (ELG7500)

**Sujets choisis en électromagnétisme.**

Sujets d'intérêt courant dans la matière.

Engineering 92.541 (ELG5104)

**Electromagnetic Waves: Theory and Applications**

The homogeneous wave equation. Uniform and non-uniform plane waves. Inhomogeneous wave equations. Green's functions. Theory of potentials. Scattering problems. Numerical methods. Boundary value problems. Perturbation and variational techniques.

Prerequisite: ELG4101 or the equivalent.

Engineering 92.542 (ELG5379)

**Numerical Methods in Electromagnetic Engineering**

Electrostatic and electrodynamic field problems, introduction to numerical and field-theoretical modelling. Finite difference techniques, method of lines, spectral domain approach, transmission line matrix and beam propagation methods. Modal analysis of inhomogeneous cross-section waveguides, scattering problems in planar microstrip circuits, propagation problems in integrated optical waveguides.

Prerequisites: ELG4103 or the equivalent.

Engineering 92.543 (ELG5504)

**Ondes électromagnétiques: théorie et applications**

Équation homogène d'ondes. Ondes planes uniformes et non uniformes. Équation non homogène d'ondes. Fonctions de Green. Théories des potentiels. Problèmes de diffraction. Méthodes numériques. Problèmes avec conditions aux limites. Méthodes des perturbations et variation.

Prerequisite: ELG4103 or the equivalent.

Engineering 92.544 (ELG7100)

**Topics in Electromagnetics I**

Current topics in the field.

Engineering 92.545 (ELG7101)

**Topics in Electromagnetics II**

Current topics in the field.

Engineering 92.546 (ELG5779)

**Méthodes numériques en génie électromagnétique**

Une introduction aux méthodes modernes de résolution numérique des problèmes électromagnétiques. Le cours couvre des problèmes déterministes et aux valeurs propres. Les méthodes suivantes seront présentées: différences finies, éléments finis, analyse dans le domaine spectral, analyse par modes hybrides, méthode t.l.m. Les méthodes seront appliquées aux problèmes suivants: antennes, guides d'ondes à section arbitraire, lignes microrubans et lignes quasi-planaires, discontinuités dans les lignes de transmission, conception par ordinateur de composants hyperfréquences. Prerequisite: ELG4103 and ELG4104, or the equivalent.

Engineering 92.550 (ELG5371)

**Digital Communications by Satellite**

Overview of satellite communications. Channel characterization and link budget calculations. Transponders: a transponder model, channelization, frequency plans, processing transponders. Earth station technology: modems (BPSK, QPSK, MSK, etc., coherent versus differential detection), low noise amplifiers, high power amplifiers. Forward error correction for satellite links. Propagation and interference considerations. Satellite access techniques: FDMA, TDMA, CDMA, random multiple access. Satellite switching and on-board processing. Networking and Services. Integrated services digital satellite network. VSAT, MSAT, Intelsat and Inmarsat.

Prerequisite: ELG4171 or the equivalent.

Engineering 92.551 (ELG5170)

**Information Theory**

Overview of information theory: source coding, channel coding and data encryption. Measure of information: entropy, equivocation mutual information, relative entropy. Continuous channels and sources: differential entropy and mutual information of continuous sources and channels. Sources and channels with memory. Source coding: fixed-length and variable-length codes. Typical sequences and Asymptotic Equipartition Property. Source coding theorem. Kraft inequality. Huffman codes. Universal Codes. Channel coding for noisy channels. Channel capacity: memoryless channels and channels with memory. Blahut-Arimoto algorithm. Channel coding theorem. Random coding exponent and channel reliability function. Data compression and distortion measures. Quantizers. Rate-distortion function. Source compression coding theorem. Blahut algorithm for rate-distortion. Multiterminal information networks. Capacity of multiple access schemes.

Prerequisite: ELG5119 or 94.553 or the equivalent.

Engineering 92.553 (ELG5179)

**Detection and Estimation**

An introduction to the optimal processing of communication signals. The binary hypothesis testing problem. Bayes risk and Neyman-Pearson criteria based receivers. M-ary hypothesis detection problems. Composite hypothesis problems. Parameter estimation criteria; Cramer-Rao bounds; maximum likelihood estimation. Function space concepts. Integral equations; the Karhunen-Loeve Expansion Theorem. Detection problems of signals in additive white Gaussian noise. Detection problems in coloured noise; the whitening filter; singular detection. The noise-in noise problem. Classical signal estimation problems. The linear filtering problem. The Wiener filter. The Kalman filter. Sequential detection (Wald's test). Introduction to non-parametric detection.

Prerequisites: ELG5119 or 94.553; and ELG5375 or 94.554; or the equivalents.

Engineering 92.554 (ELG5372)

**Error Control Coding**

General introduction. Algebraic concepts. Linear block codes. Cyclic codes, error trapping, decoding of cyclic codes, BCH codes, majority-logic decoding of cyclic codes, finite geometry codes, burst-error correcting codes. Convolutional codes. Maximum-likelihood decoding, sequential decoding, and majority-logic decoding of convolutional codes. Burst-error correcting convolutional codes. Automatic repeat request strategies. Applications of block coding to data storage systems. Applications of convolutional codes.

Co-requisite: ELG4171 or the equivalent.

Engineering 92.556 (ELG5375)

**Principles of Digital Communication**

Elements of communication theory and information theory applied to digital communications systems. Characterization of noise and channel models. Analysis of digital data transmission techniques for additive Gaussian noise channels. Efficient modulation and coding for reliable transmission. Spread spectrum and line coding techniques. Precludes additional credit for Engineering 94.554.

Prerequisite: 94.553 or ELG5119 or the equivalent (may be taken concurrently).

Engineering 92.557 (ELG5376)

**Digital Signal Processing**

Review of discrete-time signals, systems and their representation in time and frequency domains, Z-transform, and the Discrete Fourier Transform. Fast Fourier Transform algorithms. Basic and advanced methods of FIR and IIR filter design. Spectrum analysis and short-time Fourier transform Time-fre



quency representation and the wavelet transform. Multi-rate signal processing: decimation/interpolation and decimator design. Efficient implementations. Finite word length effects. Applications, which may include A/D and D/A conversion, filterbanks and subband coding/wavelets in signal compression. Precludes additional credit for Engineering 94.562.

Engineering 92.558 (ELG5776)

**Traitement numérique des signaux**

Méthodes de traitement numérique des signaux dans le domaine fréquentiel et temporel; effets d'arrondissement sur les coefficients et accumulation des erreurs. Réalisations directes à très hautes vitesses. Réseaux systoliques. Réalisations utilisant des micro-ordinateurs. Techniques d'adaptation. Applications aux systèmes de télécommunications.

Prerequisite: ELG4172 or the equivalent.

Engineering 92.559 (ELG5378)

**Image Processing and Communications**

Introduction. Image perception. Image sampling and quantization. DFT, cosine, sine, Hadamard, Haar and KL transforms. Point operations, histogram modelling pseudo-colour and colour image enhancement. Image filtering. Image interpolation and extrapolation. Edge detection boundary extraction, region representation, structure, texture, scene matching, image segmentation and image comprehension. Image data compression: pixel coding, predictive techniques, transform coding, hybrid coding, vector quantization, subband coding, interframe coding and standards for image/video compression.

Prerequisite: ELG5376 or 94.562 or the equivalent.

Engineering 92.560 (ELG7172)

**Topics in Signal Processing I**

Current topics in the field.

Engineering 92.561 (ELG7173)

**Topics in Signal Processing II**

Current topics in the field.

Engineering 92.563 (ELG7179)

**Topics in Signal Processing III**

Current topics in the field.

Engineering 92.565 (ELG7177)

**Topics in Communications I**

Current topics in the field.

Engineering 92.566 (ELG7178)

**Topics in Communications II**

Current topics in the field.

Engineering 92.567 (ELG5374)

**Computer-Communication Networks**

Network applications, structures and their

design issues. Resource sharing/access methods. Network transmission and switching techniques. The OSI model and concepts. Error control, flow control and various issues related to the physical, data link, network and transport layers. Local area networks. ISDN. Performance evaluation in computer-communication networks such as delay throughput analysis of various resource access protocols. Precludes additional credit for Engineering 94.521.

Prerequisite: an undergraduate course in probability and statistics such as MAT2377.

Engineering 92.572 (ELG7572)

**Sujets choisis en télécommunications et en traitement de signaux.**

Sujets d'intérêt courant dans le domaine.

Engineering 92.573 (ELG5194)

**Design and Testing of Reliable Digital Systems**

Introduction. Test generation for combinatorial circuits. Fault detection in sequential circuits. Memory testing. LSI/VLSI circuit testing. Deterministic and random testing of digital circuits. Design for testability. Self-checking circuits. Design of fault-tolerant systems. Case studies.

Prerequisite: ELG5195 or the equivalent.

Engineering 92.574 (ELG5180)

**Advanced Digital Communication**

Digital signalling over channels with intersymbol interference (ISI) and additive Gaussian noise. Error probability analysis. Fading multipath channels as arise in terrestrial line-of-sight (LOS) and mobile/portable communications, diversity concepts: modelling and error probability performance evaluation. Synchronization in digital communications. Spread spectrum in digital transmission over multipath fading channels. Optical communications and networking over fibre and atmosphere. Shot noise, laser intensity noise and Gaussian noise performance limits. Precludes additional credit for Engineering 94.565.

Prerequisite: 94.554 or ELG5375 or the equivalent.

Engineering 92.575 (ELG5195)

**Digital Logic Design: Principles and Practices**

Combinational circuit analysis including hazard detection. Number systems and codes. Switching algebra. Combinational circuit design including PLA and MSI techniques. IC logic families. Flip-flop properties. Switching algebra: special properties; symmetric functions, unate functions, threshold functions, Boolean difference, and functional decomposition. Introduction to sequential circuits; state reduction, incompletely specified ma

chines, state assignment, and series-parallel decomposition. Fundamental mode sequential circuits; race, hazards, and state assignment. Testing aspects of digital systems; failure and fault models, deterministic test generation for combinational circuits, testing sequential circuits, state identification, and testing memories and complex LSI/VLSI circuits. Design for testability techniques: scan techniques, built-in self test (BIST), and easily testable network structures. Semicustom and MSI design. Special sequential circuits including sequential integrated circuits.

Engineering 92.577 (ELG5192)

**Microprocessor-Based Systems Design**

Overview of microprocessors: complex instruction set computer (CISC), microprogramable and reduced instruction set computer (RISC) machines; hardware design alternatives. The memory subsystem: main memory and virtual memory systems. The input/output subsystem: I/O schemes, digital and analog I/O ports, and bussing schemes. Multiple processor systems overview; taxonomy of multiprocessor systems. Applications of multimicro-processor systems.

Engineering 92.579 (ELG5196)

**Automata and Neural Networks**

Fuzzy systems: theory; rules and reasoning; inference systems. Regression and optimization: least-squares estimators; derivative-based optimization; derivative-free optimization, genetic algorithms, simulated annealing, random search, downhill simplex search. Neural Networks: adaptive neural networks; bidirectional associative memories; supervised learning; learning from reinforcement; Unsupervised learning. Applications: modelling; control; pattern recognition.

Precludes additional credit for Engineering 94.561 (ELG6161).

Engineering 92.580 (ELG5377)

**Adaptive Signal Processing**

Theory and techniques of adaptive filtering including gradient and LMS methods; adaptive transversal and lattice filters; recursive least squares; fast recursive least squares; convergence and tracking performance; systolic array techniques. Applications, such as adaptive prediction; channel equalization; echo cancellation; speech coding; antenna beamforming; system identification in control systems; spectral estimation; neural networks.

Precludes additional credit for Engineering ELG6160.

Prerequisite: 94.553 or ELG5119 or the equivalent; 94.562 or ELG5376 or the equivalent.

Engineering 92.587 (ELG7186)

**Topics in Computers I**

Current topics in the field.

Engineering 92.587 (ELG7187)

**Topics in Computers II**

Current topics in the field.

Engineering 92.590 (ELG7573)

**Sujets choisis sur les ordinateurs.**

Sujets d'intérêt courant dans la matière.

ELG 92.526 (ELG 5123)

**Health Care Engineering**

Overview of health care system/participants: biophysical measurements for diagnosis/monitoring; biomedical sensors/technology; telemedicine and applications; safety considerations; managing medical technologies/funding models for clinical engineering departments; considerations for developing countries.

Prerequisites: Permission of the Department.

ELG6000

**Engineering Report/Rapport technique**

For students in the course work master's program working on the Engineering Report. Pour les étudiants et les étudiantes à la maîtrise qui préparent un rapport technique.

ELG7999

**M.A.Sc. Thesis/Thèse de M.Sc.A.**

For students working towards their master's thesis. Pour les étudiants et les étudiantes qui travaillent à leur thèse de maîtrise.

ELG8000

**Co-Op Work Term I/Travail coopératif 1er stage**

For students in a cooperative master's program who are on their first work term. Pour les étudiants et les étudiantes à un programme coopératif de maîtrise qui font leur première session de travail.

ELG8001

**Co-Op Work Term II/Travail coopératif 2e stage**

For students in a cooperative master's program who are on their second work term. Pour les étudiants et les étudiantes à un programme coopératif de maîtrise qui font leur deuxième session de travail.

ELG9998

**Ph.D. Comprehensive Exam/Examen de synthèse du doctorat**

For students undergoing the Ph.D. comprehensive examination. Pour les étudiants et les étudiantes qui doivent passer l'examen de synthèse du doctorat.

ELG9999

**Ph.D. Thesis/Thèse de doctorat**

For students working towards their Ph.D. thesis. Pour les étudiants et les étudiantes qui travaillent à leur thèse de doctorat.

## English Language and Literature

Dunton Tower 1812  
Telephone: 520-2310  
Fax: 520-3544

### The Department

**Chair of the Department:** L.T.R. McDonald

**Departmental Supervisor of Graduate Studies,** R.L. Hogg

The Department of English Language and Literature offers programs of study leading to the M.A. degree in English language and literature. Additional information may be obtained by consulting the departmental supervisor of graduate studies.

### Qualifying-Year Program

Applicants who hold a general (3 year) B.A. degree with at least a high honours standing (normally B+), with a major in English language and literature, may be admitted to the qualifying-year program. Normally, these students will be required to complete 4.0 or 5.0 credits in English, as determined by the department, and to maintain a high honours standing (normally B+) before being considered for admission into the master's program.

### Master of Arts

#### Admission Requirements

The minimum admission requirement for the master's program is a B.A. (Honours) (or the equivalent) in English language and literature, with at least a high honours standing (normally B+), and including credits in at least five of the following:

- \* history of the English language or general English linguistics
- \* Old English or Middle English
- \* Renaissance literature
- \* drama (including Shakespeare)
- \* Restoration and eighteenth-century literature
- \* Romantic and nineteenth-century literature
- \* twentieth-century literature
- \* Canadian literature

Possession of the minimum entrance standing is not in itself, however, an assurance of admission into the program.

### Program Requirements

Each candidate will select one of the following program patterns:

\* 2.0 credits in English, selected from those at the 500-level (excluding English 18.598), plus English 18.505, and a master's thesis; an oral examination on the thesis will be required. A prospectus for the thesis must be submitted to the graduate committee by December 1 after registration in September, or at the end of three months for any other registration

\* 3.0 credits in English selected from those at the 500-level (excluding English 18.599), plus English 18.505, and a research essay; an oral examination on the research essay will be required

Each program is designed to be completed within the three-term academic year. Each program is of equal status.

### Guidelines for Completion of Master's Degree

Full-time master's candidates are expected to complete all requirements in twelve months or three terms of registered full-time study. Part-time master's candidates are expected to complete their degree requirements within an elapsed period of six calendar years after the date of initial registration.

All candidates are required to demonstrate a reading knowledge of one language other than English, approved by the Department.

### Academic Standing

A standing of B- or better must be obtained in each credit counted towards the master's degree.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet, published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

English 18.500F1 or W1

### Literary Criticism

A study of specific topics or particular areas of literary criticism.



English 18.502F1

**Contemporary Literary Theory**

This course examines contemporary approaches to theory and literary studies. The first half of the semester is devoted to an overview of current theoretical approaches to literature, and the second half focuses on the work of Sigmund Freud, Jacques Derrida, and Michel Foucault.

English 18.503F1

**Feminism/s: The Literary Dimension**

An examination of the configurations and discursive constructions of various cultural "spectacles," such as certain murder trials, disease outbreaks, sexual scandals, and violence in (and out of) sport. The performance of race and gender in popular culture and how these performances influence cultural assumptions and expectations are considered.

English 18.504W1

**Literature, Contact, and Empire in Colonial and Post-Colonial Societies**

An investigation of some essential European and North American documents relating to the dispossession of Native peoples from the Caribbean to the Arctic, together with the emergence of a radical critique by various Native and non-Native thinkers (Columbus, Montaigne, Cartier, Defoe, Hearne, Cooper, Jameson, Thompson, and others).

English 18.505F1

**Bibliography and Scholarly Methods**

An introduction to analytical and descriptive bibliography, editing, research methodology, and professional concerns. The course is graded Satisfactory/Unsatisfactory.

English 18.518F1 or W1

**Old Norse**

Topic may vary from year to year.

English 18.528F1 or W1

**Middle-English Studies**

A study of selected portions of Chaucer's *Canterbury Tales* from the perspective of Bakhtinian literary theory. The Miller, the Wife of Bath, the Pardoner and the Host will be among those elements of the work examined in the light of the ludic and carnivalesque and on grotesque realism. Familiarity with Rabelais and *His World* and *The Dialogic Imagination* will be involved in the course. Also offered at the undergraduate level, with different requirements, as English 18.428★, for which additional credit is precluded.

English 18.531F1 or W1

**Renaissance Poetry**

Topic may vary from year to year.

English 18.532F1 or W1

**Seventeenth-Century Poetry**

A study of selected seventeenth-century poets.

English 18.534F1

**Renaissance Drama**

Politics and the English Renaissance Stage. A study of the popular drama of Marlowe, Shakespeare, Jonson, Marston, Webster, and Tourneur, and the court drama of Peele, Jonson, Shirley, and Carew.

English 18.537F1 or W1

**Renaissance Authors**

A study of selected Renaissance authors.

English 18.538F1 or W1

**Renaissance Studies**

Topic may vary from year to year.

English 18.542W1

**Eighteenth-Century Studies**

Depictions of Friendship and Gender. An examination of the writings of Swift, Pope, and Johnson with respect to the concept of friendship and the depiction of gender. Works are examined from historical, biographical, and psychological points of view.

English 18.548F1

**Studies in Romanticism**

An examination of the fantastic element in some key texts of Romantic literature. The emphasis is on imaginative structures and on the romantic exploration of the mysterious, the exotic, and the forbidden.

English 18.551W1

**Nineteenth-Century Studies**

A study of works written between 1830 and 1870 in terms of gender representation in relation to generic modalities, exploring the thesis that poets of the period - Tennyson, the Brownings, the Rossettis, Arnold, Clough - confronted a crisis in gender ideology that problematized the lyric.

English 18.553F1 or W1

**Nineteenth-Century Fiction**

Topic may vary from year to year.

English 18.558F1 or W1

**Nineteenth-Century Literature**

Topic may vary from year to year.

English 18.561F1 or W1

**Twentieth-Century Poetry**

Topic may vary from year to year.

English 18.563F1 or W1

**Twentieth-Century Fiction**

A study of selected twentieth-century writers.

English 18.564F1 or W1

**Twentieth-Century Drama**

Topic may vary from year to year.

English 18.566W1

**Twentieth-Century Literature**

A study of the portrayal of the media as a reflection of society and its values in the twentieth-century British novel, starting with Evelyn Waugh's *Scoop* and completing the survey with Fay Weldon's *Darcy's Utopia* and Martin Amis's *The Information*.

English 18.567F1 or W1

**Twentieth-Century Authors**

A study of twentieth-century authors of fiction.

English 18.568F1 or W1

**Twentieth-Century Studies**

Topic may vary from year to year.

English 18.571F1

**American Poetry**

A study of the formative poetry and poetics of several major modern American writers, including: Whitman, T.S. Eliot, Ezra Pound, William Carlos Williams, H.D., George Oppen, Charles Olson, and Robert Creeley.

English 18.573F1 or W1

**American Fiction**

Topic may vary from year to year.

English 18.576F1 or W1

**American Literature**

Topic may vary from year to year.

English 18.578F1 or W1

**Studies in American Fiction**

Topic may vary from year to year.

English 18.581F1 or W1

**Canadian Poetry**

Topic may vary from year to year.

English 18.582F1

**Ethnicity, Multiculturalism, and Canadian Literature**

A study of Canadian literature in relation to theoretical and critical issues posed by ethnicity and other aspects of Canadian cultural diversity.

English 18.583F1

**Canadian Fiction**

The course concentrates on Canadian writing of the last twenty to thirty years, exploring it with reference to the concept of ideology, within the contexts of Marxist, feminist, and postmodernist literary theories.

English 18.585F1 or W1

**Canadian English**

Topic may vary from year to year.

English 18.587S1

**Selected Topics in Canadian Literature**

Topic may vary from year to year.

English 18.589F1 or W1

**Colonial Discourse and Native Literatures in Canada**

Topic may vary from year to year.

English 18.590F1 or W1

**Selected Topic**

Topic may vary from year to year.

English 18.591F1

**Selected Topic**

Topic may vary from year to year.

English 18.593W1

**English and Cultural Studies**

Performing Bodies and Voices: A consideration of the juncture of literature and popular culture in the twentieth-century American and Canadian contexts. An examination of fusions of blues lyric, Beat poetry, folk lyrics, performance art, comic book testimony, rap, Native and gay theatre, spoken word poetry, and dub poetry.

English 18.594F1 or W1

**Special Studies in Dramatic Literature**

Topic may vary from year to year.

English 18.598F2, W2, S2

**Research Essay**

English 18.599F4, W4, S4

**M.A. Thesis**

**Undergraduate Courses**

Graduate students may take the equivalent of 1.0 credit at the senior undergraduate level.

**Other Disciplines**

Graduate students may take the equivalent of 1.0 credit in a related discipline. The following courses may be among those of special interest:

*Comparative Literary Studies*

17.501, 17.502

This is not a complete list of all acceptable options. Students should contact the supervisor of graduate studies or the chair of the Department for approval if there are other courses they wish to take which are not on the list.

**Other Universities**

Graduate students may take the equivalent of 2.0 credits at another university or other universities. Students are especially reminded that the University of Ottawa offers a wide range of graduate courses which may be completed (under the general 2.0 credit ruling) for credit at Carleton University.

## European and Russian Studies

Paterson Hall 3A59  
 Telephone: 520-2888  
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### The Institute

**Director,** Joan DeBardeleben

An interdepartmental committee was formed in 1963 to foster teaching, research, conferences, and publications in Soviet and East European studies at Carleton. In 1970, a separate department — the Institute of Soviet and East European Studies — was established to administer the interdisciplinary programs developed by the committee. Following the collapse of the Soviet Union at the end of 1991, the Institute of Soviet and East European Studies was renamed the Institute of Central/East European and Russian-Area Studies to reflect the changing political reality in the region. In 1998, the Institute was again renamed, this time as Institute of European and Russian Studies; with the change in name, the Institute's undergraduate program was expanded to cover all of Europe. At the graduate level, the Institute continues to offer an interdisciplinary Master of Arts program in Central/East European and Russian-Area Studies with the participation of faculty members from ten disciplines (art history, business, economics, geography, history, international affairs, law, political science, Russian, and sociology) participate regularly in the institute's activities. They are joined on an occasional basis by visiting scholars from outside the University, including invited specialists from Eastern and Central Europe and the successor states to the USSR.

In recent years the Central and East European countries and the former Soviet republics have been in the midst of a transition from one type of socio-economic and political system to another, although they are still linked with each other by earlier historical experience, the common legacy of Soviet-style communism, and by a set of similar problems resulting from that legacy. Since the collapse of the Soviet Union, the field of study remains unified by a concern with understanding the nature of the transitional processes affecting the region, in their multiple social, cultural, economic, and political dimensions. Institute courses and research programs focus on several broad themes. These themes are treated in historical context, with attention to historical roots and parallels of contemporary developments. Major themes include:

- \* legacy of the Soviet system in the region and its impact on contemporary developments
- \* transition periods in the history of the region, with particular emphasis on political, economic, and social dimensions of the post-communist transition
- \* nationalism and ethnicity as forces for change in the area
- \* international integration among countries of the region, and the reintegration of the region into European institutions and the larger international community
- \* environmental problems and policies in a comparative perspective
- \* the changing relationship between state and society, with attention to ethnic, class, and gender issues

At the undergraduate level, the Institute offers an interdisciplinary B.A.(Honours) program in European and Russian Studies. The Institute also administers a program of studies leading to a Master of Arts degree in Central/East European and Russian-Area Studies, the first of its kind in Canada. The curricula for both programs are offered largely through participating departments. The M.A. program is designed for students wishing to acquire specialized knowledge of the region, including proficiency in the use of Russian as a research tool. The approach is interdisciplinary with emphasis on the social sciences and history. Students may take advantage of the university's regular academic exchanges with post-secondary institutions in Hungary, Poland, and Russia.

### Qualifying-Year Program

Applicants who have a general (3 year) bachelor's degree in one of the disciplines represented in the program, or who lack sufficient area studies or language training, may be admitted to a qualifying-year program designed to raise their status to that of honours graduates in European Studies. Students are expected to achieve high honours standing in qualifying-year courses in order to qualify for admission to the master's year.

To be eligible for admission to the qualifying-year program, an applicant must already have taken some courses in the area of European Studies, so that by the end of the program he or she will have satisfied the basic requirements for admission to the master's program. All students are normally required to have completed the equivalent of an introductory course in Russian or, at the discretion of the



Institute, two years of another of the region's languages.

### Master of Arts

#### Admission Requirements

The normal requirement for admission to the master's program is an honours degree (or equivalent), with at least high honours standing, dealing with East European Studies.

Honours graduates in other disciplines are eligible for admission provided they meet the following requirements:

- \* A total of 7.0 credits (or the equivalent) in the field should have been taken in no fewer than four different departments

- \* At least high honours standing

- \* A reading knowledge of Russian (normally equivalent to two academic years of Russian instruction, or one year with an intensive summer program) or, at the discretion of the Institute, equivalent knowledge of another of the region's languages.

#### Program Requirements

The specific requirements in the master's program are the following:

- \* European and Russian Studies 55.500 and 55.501, two 0.5 credit seminars in Central/East European and Russian-Area Studies, offered specially by the Institute and incorporating the approaches of several relevant disciplines

- \* 2.0 credits chosen with the approval of the graduate supervisor from the list below, with at least 1.0 credit (or the equivalent) at the 500-level. No more than 1.0 credit may be taken at the 400-level. No more than 0.5 credit may be taken in the Department of Russian

- \* One of the following:

European and Russian Studies 55.598, a research essay incorporating the approaches of at least two of the disciplines represented in the program; the research essay must be combined with an additional 1.0 credit, or the equivalent, chosen from those listed below (not including Russian) and must be defended orally

or

European and Russian Studies 55.599, an M.A. thesis which must combine the interdisciplinary approach with a greater degree of originality than that required of the research essay, and which must be defended orally

In both cases (55.598, 55.599) the paper should demonstrate that its author is capable of undertaking research in Russian, or in another language used in the region. The 55.599 option cannot be taken without the specific permission of the graduate supervisor.

- \* Each student must demonstrate proficiency in Russian or in another of the region's languages. A list of languages which may be selected to meet this requirement is available from the Institute. If a language other than Russian is selected (a) this language must be utilized in undertaking research for the research essay or M.A. thesis; (b) its selection must be approved by the graduate supervisor; and (c) the student must demonstrate proficiency in the language by passing a written translation examination.

Proficiency in Russian may be demonstrated in one of two ways:

- (a) successful completion of a written translation examination to be administered by the Institute, or

- (b) completion of 36.307 (Russian Syntax) and 36.308 (Russian Translation) with a minimum grade of B+, either within two years prior to admission, or as extra to the degree while enrolled in the master's program

Language courses taken to enable a student to fulfill the language requirement cannot be used to fulfill the minimum course requirements for the master's program, described above.

Students are advised to consult with the relevant departments for final course listings for 1999-2000, as changes in curricula may be made too late for inclusion in the Calendar; not all of the courses are offered every year. Undergraduate courses below the 400-level may be taken by qualifying-year students, and by students in the M.A. program as supplementary to the minimum M.A. requirements. (See the program description for the Institute in the *Undergraduate Calendar*)

#### *Art History*

11.422 Topics in Eastern Medieval Art

#### *Economics*

43.486 Comparative Economic Systems I  
43.487 Comparative Economic Systems II  
43.586, 43.587

#### *Geography*

45.460 The Changing Geography of Post-Communist Societies

45.570

*History*

- 24.455 Selected Problems in Modern German History  
 24.460 Selected Problems in Russian History  
 24.461 Selected Problems in Soviet History  
 24.560, 24.562, 24.580

*International Affairs*

- 46.522, 46.538, 46.562, 46.582, 46.584

*Law*

- 51.488 Socialist Legal Systems

*Political Science*

- 47.431 Marxist Thought  
 47.432 Contemporary Marxism  
 47.461 Foreign Policies of Soviet Successor States  
 47.514, 47.515, 47.516, 47.586

*Russian*

- 36.420 Russian for International Relations I  
 36.421 Russian for International Relations II

*Sociology*

- 53.584

*European and Russian Studies*

- 55.400 Modern Polish Society  
 55.403 Soviet and Russian Military History and Affairs  
 55.405 Environmental Problems and Politics in East Central Europe and Eurasia  
 55.406 The Business Environment in East Central Europe and the Soviet Successor States  
 55.407 Social and Political Discourse in Russia  
 55.408 Nationalism and Ethnic Conflict in Eastern and Central Europe  
 55.409 Development of the Russian North  
 55.410 Nation Building in Central and Eastern Europe  
 55.411 The Balkans  
 55.500, 55.501, 55.502, 55.505, 55.507, 55.508, 55.509, 55.510, 55.590, 55.591, 55.592, 55.593, 55.594, 55.595, 55.596

Other 400- and 500-level courses may be approved by graduate advisers as Institute of European and Russian Studies credits if they are deemed appropriate to a particular student's objectives.

**Academic Standing**

Master's candidates must obtain a grade of B- or better on each credit counted towards the degree.

**Guidelines for Completion of Master's Degree**

Students are normally expected to complete all requirements for the master's degree in four to six terms, although students entering the program with sufficient proficiency in Russian may complete the degree within one calendar year. Students participating in international exchanges will normally require longer to complete degree requirements.

**Graduate Courses**

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

E,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

**European and Russian Studies 55.500F1****Interdisciplinary Seminar I**

The theme of the seminar varies from year to year, but the continuing objective is to apply the approaches and methods of several relevant disciplines to selected themes and countries.

**European and Russian Studies 55.501W1****Interdisciplinary Seminar II**

Students should normally complete 55.500F1 before enrolling in this course. In addition to continued discussion of approaches and methods of several relevant disciplines, students will begin preparatory work on their master's research essays or theses.

**European and Russian Studies 55.502F1 or W1****State-Society Relations in Transition**

The relationship between social forces and state structures at both the national and local levels in the USSR and the post-communist states. Also offered at the undergraduate level with additional or different credit requirements as European and Russian Studies 55.402★, for which additional credit is precluded.

**European and Russian Studies 55.505F1,W1****Environmental Problems and Politics in East/Central Europe and Eurasia**

Nature, origins and policy responses viewed from economic, political and geographic perspectives. Also offered at the undergraduate level, with additional or different requirements, as European and Russian Studies

55.405★, for which additional credit is precluded.

Prerequisite: 1.0 credit in the area of East European or environmental studies, or permission of the Institute.

European and Russian Studies 55.507W1

**Social and Political Discourse in Russia**

Contemporary, social and political issues as covered in Russian-language media. Most course reading and instruction in Russian-language but student participation may be in English or Russian. Also offered at the undergraduate level, with additional or different credit requirements, as European and Russian Studies 55.407★, for which additional credit is precluded.

Prerequisite: Appropriate facility in the Russian language and permission of the Institute.

European and Russian Studies 55.508F1, W1

**Nationalism and Ethnic Conflict in Eastern and Central Europe**

Ethnic basis of nationalism in the region. Ethnic politics and trends. Also offered at the undergraduate level, with additional or different requirements, as European and Russian Studies 55.408★, for which additional credit is precluded.

European and Russian Studies 55.509F1, W1

**Development of the Russian North**

An overview of the economic, social and political development of the Russian North. Also offered at the undergraduate level, with additional or different requirements, as European and Russian Studies 55.409★, for which additional credit is precluded.

Precludes additional credit for European and Russian Studies 55.402★ (if taken before 1995-96).

Prerequisite: Permission of the Institute.

European and Russian Studies 55.510F1, W1

**Nation Building in Central and Eastern Europe**

Processes of nation-building in the region examined in terms of a particular country, or set of countries. Country focus may vary. Also offered at the undergraduate level, with additional or different requirements, as European and Russian Studies 55.410★, for which additional credit is precluded.

European and Russian Studies 55.590F1

**Tutorial in Russian-Area Studies**

A course of directed readings on selected aspects of the Soviet successor states, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.

European and Russian Studies 55.591W1

**Tutorial in Russian-Area Studies**

European and Russian Studies 55.592S1

**Tutorial in Russian-Area Studies**

European and Russian Studies 55.593F1

**Tutorial in Central and East European Studies**

A course of directed readings on selected aspects of Eastern and Central Europe, involving preparation of papers as the basis for discussions with the tutor. Offered when no regular course offering meets a candidate's specific needs.

European and Russian Studies 55.594W1

**Tutorial in Central and East European and Russian-Area Studies**

European and Russian Studies 55.595S1

**Tutorial in Central/East European and Russian-Area Studies**

European and Russian Studies 55.596T2

**Tutorial in Central/East European and Russian-Area Studies**

European and Russian Studies 55.598F2, W2, S2

**Research Essay**

A research essay on some topic relating to Central/East European and Russian-Area Studies

European and Russian Studies 55.599F4, W4, S4

**M.A. Thesis**

Other courses may be available at the University of Ottawa.



## Film Studies

St. Patrick's Building 423  
 Telephone: 520-2342  
 Fax: 520-3575  
 E-mail: filmgrad@carleton.ca

### The School

**Director,** Bryan Gillingham

**Supervisor of Graduate Studies,** Christopher Faulkner

The School for Studies in Art and Culture offers a program of study and research leading to the degree of Master of Arts in Film Studies. This is a disciplinary M.A. with emphasis upon 1) the conceptual issues current in the field, and 2) the problematics of various national cinemas and other practices.

The program will develop in students a broadly based expertise in the discipline. The study of Canadian cinema is given a high priority, but provision is also made for the study of other national cinemas, as well as for the study of other traditions outside the mainstream, such as women's cinemas, post-colonial cinemas, and minority and regional practices.

Most work in the program is on the feature fiction film and its institutional foundations as an object of study. However, in line with the expertise of members of faculty, the study of other film forms like documentary, animation, experimental film and video is a necessary part of the course offerings.

Questions of critical and historical method and problems of theory inform all of the courses in the program. This conceptual emphasis is in line with the central developments in Film Studies as a discipline over the past twenty-five years.

### Qualifying-Year Program

Applicants who lack an Honours degree, but who have a 3 year degree in Film Studies or a related discipline with a minimum standing of B+, may be admitted to a qualifying-year program. Students who complete the qualifying-year requirements with high honours standing or better will be considered for admission to the master's program. The regulations governing the qualifying-year are outlined in the general section of this calendar (see p. 50).

## Master of Arts

### Admission Requirements

The minimum requirement for admission to the Master's program in either a full-time or part-time capacity is a B.A. (Honours) or the equivalent in Film Studies or a related discipline with high honours standing. Related disciplines might include Mass Communication, Art History, Literature, Canadian Studies, Women's Studies, and History. Applicants without a background in Film Studies may be required to take a maximum of two full credits from designated courses in the undergraduate Film Studies program in addition to their normal M.A. program requirements.

### Program Requirements

The specific program requirements for students in the M.A. program are as follows:

- \* 1.0 core credit required
- \* 2.0 additional credits
- \* Thesis (equivalent to 2.0 credits)
- \* Total of 5.0 credits required

In choosing the two additional credits beyond the core seminar and the thesis, students may take 0.5 credit outside the Film Studies program subject to the approval of the Graduate Supervisor.

Because of the strong conceptual demands of the program and the expectation that students be able to synthesize ideas in a substantial piece of written work, the research essay option will not be available in partial fulfillment of the requirements of the degree.

### Deadlines

Normally, full-time students should complete their course work by the end of the second term, and part-time students by the end of the fifth term.

### Thesis Proposal

Students will normally submit a detailed thesis proposal to the thesis proposal committee no later than March 1 of the first year of registration for students enrolled full-time and no later than the middle of the fifth term of registration for students enrolled part-time.

### Language Requirements

A reading knowledge of French (or another language approved by the Film Studies Graduate Supervisor) is required.

## Academic Standing

A standing of B- or better must be obtained in each course counted towards the master's degree.

## Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Film Studies 19.500T2

### Directions in Film Theory and Film History

This course is intended to acquaint all students in the program with recent developments in the areas of film theory and film history. Topics to be covered may include spectatorship, identity and gender politics, cultural studies, fan cultures, performance, reception theory, the formation of taste, the construction of audiences, discourse analysis, historical method, and the concepts of national and transnational cinemas.

Film Studies 19.501F1, W1, S1

### Directed Readings and Research

Tutorials designed to permit students to pursue research on topics in Film Studies which have been chosen in consultation with members of faculty.

Film Studies 19.502F1 or W1

### Special Topics

This course offers selected topics in film studies not available in the regular course program.

Film Studies 19.515F1 or W1

### Changing Practices

This course looks at traditional and recent developments in the practice of non-feature film forms such as the documentary, the newsreel, experimental film, video and television. Both the aesthetic particulars which distinguish these forms from the fiction feature film and their social and cultural roles are examined.

Film Studies 19.521F1 or W1

### Topics in European Cinema

Some aspect of European cinema is the focus of this course. A particular period, movement, style, genre, narrative development or co-production practice may be dealt with. Emphasis

will be upon the problematic concept of a national cinema in the light of current debates about nation-ness. Examples to be studied include Britain, France, USSR/Russia, Italy, Germany.

Film Studies 19.522F1 or W1

### Cinemas of the America

This course examines one or more of the cinemas of the United States, the Caribbean, Latin America and Brazil. A particular period, movement, style, genre, narrative development or some relationship between these cinemas may be dealt with. Emphasis will be upon the problematic concept of a national cinema in the light of current debates about nation-ness.

Film Studies 19.524F1 or W1

### Cultural Mediations

This course examines the processes of mediation that operate between mainstream and alternative, independent or marginal film industries and practices. The presence of third world cinemas in the first world, the reception of first world cinemas in the third world, ethnic cinemas, co-productions, art cinemas, video art, and subcultural practices, along with their discourses of appropriation and/or intervention are of particular interest.

Film Studies 19.528F1 or W1

### Historical Traditions in Canadian Cinema

Selected aspects of the history of cinema in Canada are the focus of this course. Emphasis is placed upon the role that institutional bodies, government policies, economic decisions, aesthetic traditions, and related cultural practices have had on the history of Canadian cinema.

Film Studies 19.529F1 or W1

### Critical Perspectives on Canadian Cinema

This course examines current critical approaches to Canadian film. Attention will be given to the influence of Canadian cultural theory on thinking about cinema in Canada. Methodological issues will be dealt with in the light of the influence of foreign theory and criticism on film studies in Canada.

Film Studies 19.541F1 or W1

### Studies in Authorship

This course offers detailed attention to the work of one or two filmmakers, with a concern for recent ideas about the concept of authorship and the formation of artistic and critical reputations.

Film Studies 19.550F1 or W1

### Advanced Film Analysis

This course examines issues and approaches to the detailed analysis of particular film texts. Work in narratology, hermeneutics, discourse

analysis, psychoanalysis, deconstruction and semiotics will provide the methodological background to the study of individual films.

Film Studies 19.551F1 or W1

#### **Gender and Cinema**

The social production and reproduction of gender and gender relations through the cinema and its representations are examined in this course. The consequences of this work for feminist, gay and lesbian film practices and politics form an important part of the course.

Film Studies 19.561F1 or W1

#### **Studies in Genre**

The theory and practice of film genres will be the object of study in this course.

Film Studies 19.571F1 or W1

#### **Topics in Animation**

Institutional histories, the work of individual animators, modes of production, and the social function of animation represent topics to be covered by this course.

Film Studies 19.590F1 or W1

#### **Cinema and Modernism**

This course examines cinema's relationship to the history and theory of modernism. The concerns of classical film theory, the emergence of avant-garde, modernist film practices, and film's relationship to other twentieth-century art forms represent areas of study in this course.

Film Studies 19.591F1 or W1

#### **Cinema and the Postmodern**

An examination of cinema's relationship to the history and theory of postmodern cultural practices in performance art, video, multimedia, architecture, literature, music, and other examples of artistic postmodernism is the focus of this course.

Film Studies 19.599

#### **M.A. Thesis**



## French

Dunton Tower 1602  
Telephone: 520-2168  
E-mail: french@carleton.ca

### The Department

**Chair of the Department, D. Rosse**

**Departmental Supervisor of Graduate Studies, C. Doutrelepon**

The program of studies leading to a Master of Arts degree in French consists of courses (0.5 credit each) covering the fields of French linguistics, linguistic analysis of literary discourse, literary history, and literary criticism. The availability of a great variety of courses and the existence of 20.580, 20.597, 20.598, and 20.599, in which the student establishes course content in consultation with his/her adviser, allow for considerable flexibility and choice in wide ranging or highly specialized studies.

### Qualifying-Year Program

Applicants who hold a general (3 year) bachelor's degree with at least B standing or higher, with a major in French, are required to register in the qualifying-year program (normally 5.0 credits in French chosen from those numbered at the 400-level), and maintain at least B+ standing overall, before proceeding to the M.A. program.

Qualifying-year students should consult the Undergraduate Calendar for a listing of 400-level courses.

### Master of Arts

#### Admission Requirements

The normal requirement for admission into the master's program is a B.A.(Honours) in French with at least high honours standing (normally B+ or better in Honours subject; B- or better overall).

#### Program Requirements

Students establish their programs in consultation with an adviser from the Department who will normally be the Supervisor of Graduate Studies or the professor with whom they take 20.597, 20.598, or 20.599.

The following three options are available:

\* 4.0 credits of which at least 3.0 credits must be chosen from courses at the 500-level; and an oral and written examination (Comprehensive) equivalent to 1.0 credit, in which the

student demonstrates a good grasp of the tools and methods of scholarship, as well as competence in three chosen specialized areas

\* 4.0 credits of which at least 3.0 credits must be chosen from courses at the 500-level; and a Research Essay equivalent to 1.0 credit (French 20.598), with an oral examination

\* 3.0 credits of which at least 2.0 credits must be chosen from courses at the 500-level; and a master's thesis equivalent to 2.0 credits (French 20.599), with an oral examination

With the approval of the supervisor of graduate studies, M.A. students in French may select the equivalent of 1.0 credit at the graduate or senior undergraduate level outside the 500-level courses offered by the Department.

### Guidelines for Completion of Master's Degree

Normally, all full-time students are expected to fulfill the requirements of the M.A. program by the end of the fifth term of study. Generally, students should be able to complete their program within four terms.

Students are required to file with the Department of French a detailed proposal of their thesis, research essay or comprehensive exam. Full-time master's candidates are required to submit this proposal by the end of the ninth month of full-time registration.

### Academic Standing

A grade of B- or better must be obtained in each credit counted towards the master's degree.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

The graduate courses offered by the Department are open to students in the M.A. program and, with permission of the Department, to students in the qualifying-year program. For prerequisites, please consult the Department.

French 20.501F1 or W1

*Théories linguistiques françaises*  
Topic may vary from year to year.

French 20.502W1

**Linguistique du français I**

Topic may vary from year to year.

French 20.503F1

**Linguistique du français II**

Identification et compréhension des diverses composantes du système linguistique et de leurs interactions. Approche lexicaliste. Syntaxe minimaliste: spécificateur-tête-complément. Principes et contraintes. Étude paramétrique et variationnelle de quelques propriétés syntaxiques du français. Les mouvements et les variations du GN. Le verbe et ses arguments. La complémentation.

Also offered at the undergraduate level, with different requirements, as French 20.480, for which additional credit is precluded.

French 20.504F1 or W1

**Linguistique du français canadien**

Topic may vary from year to year.

French 20.506W1

**Linguistique du français langue seconde**

Étude de l'évolution des méthodologies d'apprentissage. a) Tableau panoramique (description, fondements, critique). b) Développement de la société; évolution des sciences sociales. c) Perspectives sur l'interculturel, les conséquences de la «globalisation», l'importance des langues des minorités, la relation avec les droits de la personne.

French 20.507F1

**Traduction: théorie et pratique**

Poésie et traduction. Après une introduction théorique, définitions générales, traduction de la métaphore, des jeux de mots, traduction féministe, les exercices pratiques porteront sur la traduction en français de textes de poètes canadiens-anglais et anglophones et en anglais de textes de poètes québécois et francophones.

French 20.520W1

**Aspect linguistique particulier**

Francophonie et français contemporains. État de la francophonie dans le monde. Sociolinguistique et évolution historique des français contemporains. Enjeux socio-économiques et politiques. Le français des Amériques.

French 20.541F1 or W1

**Sémiotique littéraire**

Topic may vary from year to year.

French 20.542F1

**Littérature et rhétorique**

Fictionnalité, rhétorique et historiographie dans trois romans français du 19<sup>e</sup> siècle: théories et pratiques. V. Hugo, *Notre-Dame de Paris*, Dumas père, *La Reine Margot*, Flaubert, *Salammbô*.

French 20.543F1 or W1

**Littérature et idéologie**

Topic may vary from year to year.

French 20.544W1

**Auteurs I**

Ironie et satire dans le roman réaliste au XIX<sup>e</sup> siècle. On étudiera six romans (Stendhal, Balzac, Flaubert, Zola, Maupassant, Barbey d'Aurevilly) pour dégager les formes d'ironie et de satire qui leur sont caractéristiques.

French 20.545F1 or W1

**Themes, écoles, mouvements**

Topic may vary from year to year.

French 20.546F1

**Genres I**

Théâtre: La Dramaturgie francophone. Cerner une poétique théâtrale de la résistance aux Antilles francophones/créolophones (Haïti, Martinique et Guadeloupe), à partir de la dramaturgie d'Aimé Césaire, de Daniel Boukman, de Vincent Placol, de Maryse Condé et de Frankétienne.

French 20.546W1

**Genres I**

Rire au Moyen Âge. Rire et société, religion et morale, aspects de la satire. Thèmes: l'anticléricalisme, l'antiféminisme, la nouveauté, la politique, les classes sociales. Textes bilingues, ancien français et français moderne.

French 20.547F1 or W1

**Genres II**

Topic may vary from year to year.

French 20.548F1 or W1

**Littérature française I**

Topic may vary from year to year.

French 20.549F1 or W1

**Littérature française II**

Topic may vary from year to year.

French 20.550F1

**Littérature canadienne-française I**

Le rôle de la mémoire collective et personnelle dans la littérature québécoise: *L'Amélanchier* (Jacques Ferron), *Les Masques*, Gilbert La Rocque, *Kamouraska* (Anne Hébert), *Le Cycle* (Gérard Bessette), *L'Élan d'Amérique* (André Langevin), *Il n'y a pas de pays sans grand-père* (Roch Carrier).

French 20.551F1 or W1

**Littérature canadienne-française II**

Topic may vary from year to year.

French 20.561F1 or W1

**Sémiotique culturelle**

Topic may vary from year to year.

## French

French 20.562F1 or W1

### **Littérature, société, communication**

Topic may vary from year to year.

French 20.563F1 or W1

### **Littérature et les autres arts**

Topic may vary from year to year.

French 20.564F1 or W1

### **Paralittératures**

Topic may vary from year to year.

French 20.570W1

### **Aspect littéraire culturel particulier**

Étude des questions principales abordées par l'écriture et la théorie féministes, en France et au Québec. Analyses d'oeuvres littéraires féministes à la lumière de la théorie féministe, et vice versa. Textes théoriques et/ou fictifs de L'Irigaray, H.Cixous, M.Duras, N.Brossard, E.Théoret, D.Boucher, L.Bersianik.

French 20.580F1, W1, S1

### **Cours de lectures dirigées**

Sujet établi sur proposition de l'étudiant en consultation avec son conseiller.

French 20.597F2, W2, S2

### **Comprehensive Examination**

French 20.598F2, W2, S2

### **Mémoire de recherche**

Tout(e) étudiant(e) qui ne fait pas de thèse, choisira un directeur d'études avec qui il/elle préparera un mémoire d'une cinquantaine de pages sur un sujet de son choix. Ce travail sera sanctionné par un examen oral.

French 20.599F4, W4, S4

### **M.A. Thesis**



# Geography

Loeb Building B349  
Telephone: 520-2561  
Fax: 520-4301

## The Department

**Chair of the Department,** To be announced

**Departmental Supervisor of Graduate Studies,** D. Bennett

The Department of Geography and Environmental Studies offers programs of study and research in human and physical geography leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy. Doctoral studies in physical geography may be undertaken in cooperation with the Ottawa-Carleton Geoscience Centre.

Students are accepted into the graduate program based on the standard of previous academic work, research interests, letters of reference, and the availability of faculty to act as supervisors. Each student's program of study, as far as possible, is based on the interests of the individual, although certain courses may be required. An advisory committee, consisting of the student's research supervisor and at least one other member of the faculty, is established to monitor progress and provide thesis research guidance.

Excellent research laboratory facilities exist for the geotechnical study of near surface processes, and the physics, chemistry, and thermodynamics of earth materials, as well as for computer cartography and for remote sensing. These facilities are supported by a highly qualified full-time staff in laboratory instrumentation, cartography, and computing. There is a specialized Map Library in the geography building. The university's location in Canada's capital city offers students access to important federal resources, such as the National Library, the Public Archives of Canada, the Canada Centre for Remote Sensing, Statistics Canada, and the specialist libraries of many government departments.

Systematic interests of Departmental members are applied to a variety of world regions, although emphasis is given to Canada (including northern studies) and the Third World (especially Africa). The main clusters of specialization within the Department are the following:

### *Physical Geography and Geotechnical Science*

Studies of natural processes close to the earth's surface and their geotechnical significance; climate-ground interaction; geocryology; chemical, physical, and thermodynamic char-

acteristics of soils and sediments; hydrology. (C.R. Burn, N.C. Doubleday, Joyce Lundberg, M.W. Smith, J.K. Torrance, P.J. Williams)

### *Resource Development*

Identification and analysis of development processes; the interplay of environmental, demographic, social, gender, political, and economic variables in the spatial development of land resources, settlement systems, outdoor recreation, tourism, and natural resource-based industries; environmental impact assessment and environmental management. Canadian and Third World development is stressed. (R.D. Bollman, M.J. Brklacich, John Clarke, M.F. Fox, A.F.D. Mackenzie, E.W. Manning, G.I. Ozornoy, M.H. Sadar, M.W. Smith, S.J. Squire, D.R.F. Taylor, J.K. Torrance, A.I. Wallace)

### *Cultural, Historical, and Political Geography*

Rural and urban settlement history; ethnicity; territorial organization and the concepts of state, group politico-territorial identities, territoriality, and self-determination; role of territory in conflict situations; perceptions of environment and geographies of the mind; gender as a cultural variable; urban heritage conservation. (John Clarke, Simon Dalby, N.C. Doubleday, Fran Klodawsky, V.A. Konrad, E.J. Marshall, S.J. Squire, I.C. Taylor, John Tunbridge)

### *Social and Economic Geography*

Geographical analyses of the social and economic organization of societies; area variations in social well-being; medical geography; provision of public and informal services in changing local and regional environments; implications of gender roles for environmental restructuring; industrial systems; philosophy of science and of geography. (David Bennett, Simon Dalby, Fran Klodawsky, A.F.D. Mackenzie, E.J. Marshall, G.I. Ozornoy, A.N. Spector, A.I. Wallace)

### *Computer Cartography and Remote Sensing*

Development of applications in computer cartography and the use of remote sensing in geographical research. (M.F. Fox, D.J. King, D.R.F. Taylor)

## Qualifying-Year Program

Applicants with exceptional promise who have a general (3 year) bachelor's degree, or who have substantially less than the Honours B.A. in Geography, may be admitted to a qualifying-year program. To be considered for admission into the master's program, qualifying-year students must attain at least an overall high honours standing in their qualifying-year geography courses. The General Regulations section of this Calendar provides details about the regulations governing the qualifying year (seep. 50.)

## Master of Arts

### Admission Requirements

The normal requirement for admission into the master's program is a B.A.(Honours) or B.Sc.(Honours) in Geography, with at least high honours standing. In exceptional cases, pertinent work experience may be considered in support of an application to the Department. Applicants who have taken their undergraduate degree in the physical or natural sciences or engineering, as well as in physical geography, will be considered if their research interests coincide with those of the Department. Applicants in human geography may be accepted from related fields if their proposed research is closely related to faculty research experience. Students with academic deficiencies may be required to take additional courses.

### Program Requirements

The M.A. in Geography normally takes from twelve to eighteen months, but field work may necessitate some extension. All master's students in geography are required to complete a minimum of 5.0 credits, including an M.A. thesis which must be successfully defended at an oral examination. All students are required to have a reading knowledge of the language considered essential to their research.

In addition to the formal requirements, M.A. students will normally be required to attend a Research Proposal Workshop and the Departmental Seminar series.

### Doctor of Philosophy

The doctoral program in geography is structured around two fields:

- \* the geography of societal change with emphasis on the global political economy; restructuring and the environment; geographies of socio-cultural evaluation; feminist geographies

- \* the geography of environmental change with emphasis on environmental processes and anthropogenic impacts; appraisal and societal management of environmental resources

Students in each field are required to complete 45.600/45.601 which addresses substantive and methodological issues arising out of the interactions of social and environmental systems. Every student's thesis committee will include at least one faculty member from the field other than the chosen field.

## Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree (or the equivalent) in geography, with at least an A-average. A student already registered in the M.A. program who shows outstanding academic performance and research promise may be permitted to transfer to the Ph.D. program with a recommendation by the Departmental graduate committee.

Applicants whose academic preparation has deficiencies in certain areas may be admitted to the Ph.D. program with the requirement that they complete additional course work.

Admission to the Ph.D. program is granted on a full-time basis in September for the Fall term. In exceptional cases, a part-time program may be considered.

### Program Requirements

Program requirements for the Ph.D. degree are outlined in the General Regulations section of this Calendar (see p. 53.) The specific program requirements of the Department of Geography and Environmental Studies are:

- \* 10.0 credits

- \* Geography 45.600/45.601

- \* *Either* Geography 45.603/45.604 *or* Geography 45.606/45.607

- \* Two written comprehensive examinations including Geography 45.695 and *either* Geography 45.696 *or* Geography 45.697

- \* Presentation and oral defence of the thesis proposal as outlined below

- \* Language requirement as outlined below

- \* A thesis equivalent to 8.0 of the required 10.0 credits which must be defended at an oral examination

#### Comprehensive Examinations

Each doctoral candidate is required to write two comprehensive examinations:

- \* Geography 45.695

- \* One other examination in the chosen field of specialization

The comprehensive examinations must be completed after course requirements for the Ph.D. have been completed. Normally this will be the end of the third semester, but must be no later than the end of the fall semester of the second year of registration in the Ph.D. program.

## Thesis Proposal

Candidates normally register in the thesis on entry to the program and work actively to define their research topic during the first term of registration. The thesis proposal must be presented after comprehensive requirements have been fulfilled. Candidates normally submit and defend the thesis proposal at an oral examination no later than the end of the fourth term of registration in the Ph.D. program. Continuous registration is required after initial registration in the thesis.

## Language Requirement

All Ph.D. candidates are required to demonstrate an ability to comprehend geographical literature in a language other than English. This will normally be satisfied in the context of course work for the core and field seminars. The other language will normally be French, but may be an alternative pertinent to their research, as recommended by the thesis committee. Fluency in a second language required to undertake field research may be substituted as a fulfillment of this requirement.

## Residence Requirements

All Ph.D. candidates must be registered full time in a minimum of six terms to satisfy the residence requirement.

## Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

In addition to the selection of courses offered by the Department, graduate students in geography are encouraged to consider, in partial fulfillment of their degree requirements, appropriate courses offered in such disciplines as biology, chemistry, economics, engineering, geology, history, international affairs, physics, political science, and sociology.

Courses at the University of Ottawa may also be taken for credit in a Carleton M.A. program; permission of the Departments in both universities is required.

Geography 45.500F1

### Approaches to Geographical Enquiry

A review of the major philosophical perspectives shaping research and explanation by geographers. Particular attention is paid to interpretations of social structure and human action, the nature of the biophysical universe, and the interaction between human beings and their environments.

Geography 45.501F1,W1

### Modelling Environmental Systems

An introductory seminar in methods and problems of research on the physical environment. With illustrative material taken mostly from the atmospheric and surface earth sciences, issues such as the identification and behaviour of environmental systems, temporal and spatial scale, experimental method under field conditions, and simulation and model development are considered.

Geography 45.505W1

### Global Environmental Change: Human Implications

Global environmental change: its significance for societies, economies and international relations. Value systems underlying environmental discourse; political economy of the environment; sustainability and security. Environmental diplomacy and grassroots environmentalism. Regionalized impacts of pressures on natural environments; challenges of adaptation. (Also listed as International Affairs 46.571)

Geography 45.517F1, W1, S1

### Field Study and Methodological Research

Field acquisition and analysis of geographic material; supervised field observations and methodology. (Individual or group basis, by special arrangement).

Geography 45.520F1

### Issues in Development in Africa

Analysis of structures and processes of political, social, and economic change in intertropical Africa at scales ranging from the intrahousehold and local community to the state and international system. An objective is to integrate gender and the environment into analyses which draw on theories of political economy. (Also listed as International Affairs 46.563)

Geography 45.530F1

### Soil Thermal and Hydrologic Regimes

Characteristics of soil regimes, particularly in freezing soils; role of soil properties; analytical and numerical methods, including computer simulation. (Alternates with Geography 45.532)



## Geography

Geography 45.533W1

### **Geocryology**

Development of ground ice in permafrost regions of Canada; ice segregation and pore-water expulsion during ground freezing; analytical and numerical approaches to modelling permafrost conditions.

Prerequisite: Geography 45.418 or permission of the Department.

Geography 45.534F1

### **Aspects of Clay Mineralogy and Soil Chemistry**

The role of clay minerals in soils will be considered from a geotechnical and/or biological perspective.

Geography 45.537W1

### **Soil Resources**

The properties of soils, development, classification, productive potential, and management problems of the world's soils. Primary emphasis will be agricultural, but environmental and geotechnical aspects will be considered.

Geography 45.540F1

### **Territory and Territoriality**

Contemporary geographical and international relations theorizing is challenging notions of boundaries and territories in the political organization of modernity. Using contemporary writings on geopolitics, security, sovereignty, self-determination and identity politics this course investigates territoriality as a political and intellectual strategy. (Also listed as International Affairs 46.542)

Geography 45.541F1

### **Society and Space**

Analysis of geographers' contributions to contemporary social theory and of the geographical significance of theoretical debates in related fields.

Geography 45.542F1

### **Selected Concepts in Social Geography**

Theme to be announced.

Geography 45.543F1

### **Selected Concepts in Cultural Geography**

Investigation of a substantive theme in cultural geography. Theme to be announced.

Geography 45.544W1

### **Gender and Environments**

This course examines the relation between gender role change and the creation and use of environments. Changes in people's activities, in the first and third worlds, are assessed in the context of feminist analyses. Conceptual and methodological skills for gender-sensitive research are developed. Subsequent directed field experience may be achieved by taking 45.517.

Geography 45.545W1

### **Problems in Historical Geography**

Philosophical and methodological approaches in geography, history, and historical geography, emphasizing the use of primary documents, model building, and statistical methods as they relate to the historical geography of Canada. Also offered at the undergraduate level, with different requirements, as Geography 45.435, for which additional credit is precluded.

Geography 45.550F1

### **Globalization and Localities**

A review of recent theoretical and methodological debate in this field and analysis of the changing geography of production, employment, and social consumption in advanced economies. Policy issues will be considered.

Geography 45.555W1

### **Tourism Development**

The nature of tourist development in various parts of the world, with special emphasis on its cultural and economic implications.

Geography 45.558W1

### **Agribusiness North and South**

Analysis of the transformation of agriculture into an integrated multi-sectoral food production system and of its theoretical implications. Focus on the growth and strategies of agribusiness institutions in advanced industrial societies and on their penetration into, and impact upon, Third World economies. (Also listed as International Affairs 46.534)

Geography 45.570W1

### **Problems of Development in Arctic and Subarctic Environments**

Research seminar on specific problems in Canada's northland. Experience from other parts of the world will be incorporated when appropriate.

Geography 45.572W1

### **Issues in Canadian Resource Development**

The economic, environmental, and social challenges facing Canadian resource-based industries and the communities they support. Focus on the agricultural, energy, forest, and mineral sectors. The global and national contexts of the political economy of production, marketing, and resource management are reviewed.

Geography 45.573F1, W1

### **Natural and Regional Resource Analysis**

A review and critical appraisal of selected methods for natural and regional resource analysis such as plan evaluation methods, input-output models, resource optimization models, natural resource accounting, and ecological economics.

Geography 45.580W1

**Spatial Information Systems**

Advanced concepts and problems involved with spatial information systems, especially those with a mapping component.

Geography 45.583W1

**Remote Sensing and Image Analysis**

Radiometric, geometric, and resolution characteristics of remotely sensed data; image processing algorithms; analysis of spectral, textural, and contextual image information; applications to vegetation mapping and environmental analysis.

Geography 45.584F1

**Introduction to Geographic Information Systems**

Introduction to geographical application of GIS for students with no previous experience. Includes benefits and limitations of GIS, data formats and structures, input/output capabilities, analysis functions, and applications.

Geography 45.590F1, W1, S1

**Graduate Tutorial**

Tutorial, directed reading or research, offered on an individual basis, to meet specific program needs; may be taken in one of the areas of specialization of the Department.

Geography 45.599F4, W4, S4

**M.A. Thesis**

Thesis supervision will be given in all areas of specialization of the Department, as listed on p. 181.

\* 600-level courses are open only to students registered in the doctoral program.

Geography 45.600F1, 45.601W1

**Doctoral Core Seminar: Geography, Society and the Environment**

The intellectual history of society/environment interrelations in western thought and contemporary critiques thereof; the treatment of the environment within major political philosophies and its bearing on global patterns of economic and social development; the structure and social origins of contemporary discourse concerning global environmental change; the articulation of scientific research and uncertainty with processes of environmental policy making; the political economy of local, national, and international responses to perceived threats to environmental integrity. The course prepares students for the comprehensive examination on geography, society and the environment. The course is required of all first-year doctoral students. Evaluation is by letter grade. The course is team-taught by two faculty members representing the two major fields of the program, the geography of social change and the geography of environmental change.

Geography 45.603F1, 45.604W1

**Field Seminar: Geography of Societal Change**

Analysis of current geographical and related research into the three themes of global political economy, restructuring and the environment; geographies of socio-cultural evaluation; and feminist geographies. The course prepares students for their field comprehensive examination. The course is required of all first-year doctoral students in this field. Evaluation is by letter grade.

Geography 45.606F1, 45.607W1

**Field Seminar: Geography of Environmental Change**

Analysis of current geographical and related research into the two themes of appraisal and societal management of environmental resources, and environmental processes and anthropogenic impacts. The course prepares students for their field comprehensive examination. The course is required of all first-year doctoral students in this field. Evaluation is by letter grade.

Geography 45.695F1, W1, S1

**Comprehensive Examination: Geography, Society and the Environment**

Based on the core seminar, Geography 45.600/45.601, this examination will involve a general knowledge of: the intellectual history of society/environment interrelations in western thought and contemporary critiques thereof; the treatment of the environment within major political philosophies and its bearing on global patterns of economic and social development; the structure and social origins of contemporary discourse concerning global environmental change; the articulation of scientific research and uncertainty with processes of environmental policy making; the political economy of local, national, and international responses to perceived threats to environmental integrity. The examination will take the form of a major research paper whose specific nature will be defined by a committee comprised of the two instructors of the core seminar and a member of the student's advisory committee (normally the supervisor). Evaluation is on the basis of *Pass*, *Pass with Distinction*, *Fail*.

Geography 45.696F1, W1, S1

**Comprehensive Examination: The Geography of Societal Change**

Based on the field seminar Geography 45.603/604, this examination will focus on substantive research challenges in theory and methodology associated with the themes of the field: global political economy, restructuring and the environment; geographies of socio-cultural evaluation; feminist geographies.

## Geography

Geography 45.697F1,W1,S1

### **Comprehensive Examination: The Geography of Environmental Change**

Based on the field seminar, Geography 45.606/45.607, this examination will focus on substantive research challenges in theory and methodology associated with the themes of the field: appraisal and societal management of environmental resources; environmental processes and anthropogenic impacts. The field comprehensive examination will take the form of a major research paper whose specific nature will be defined by the student's advisory committee. It will require the student to situate the topic area of research within the literature and methodological practices of the field. The advisory committee will form the examining board of the comprehensive. Evaluation is on the basis *Pass, Pass with Distinction, Fail*.

Geography 45.699F,W,S

### **Ph.D. Thesis**



# The Ottawa-Carleton Geoscience Centre

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Université d'Ottawa  
University of Ottawa



Carleton University

## The Centre

### Director of the Centre, Keith Benn

Established in 1982, the Ottawa-Carleton Geoscience Centre, a joint initiative of Carleton University and the University of Ottawa, offers programs leading to the degrees of M.Sc. and Ph.D. in most areas of geoscience. The Centre houses modern instrumental facilities, and research activity includes most areas of earth science.

The size of the Centre and its location in the nation's capital offer unique opportunities for collaborative research over a broad range of disciplines. Of particular note is the Centre's close collaboration with the Geological Survey of Canada. The campuses are fifteen minutes apart by complimentary inter-university transport and within a short distance of most federal facilities.

Graduate students are enrolled in the university where their faculty supervisors hold appointments. Students draw from a program of courses in English or French and may pursue their research in either language.

Applications for graduate admission are made to the director of the Centre.

The research interests of members of the Centre are listed below.

## Members of the Centre

The home department of each member is indicated by (CU) for the Department of Earth Sciences, Carleton University; (UO) for the Department of Geology, University of Ottawa; (CE) for the Department of Civil Engineering, Carleton University; (PHY) for the Department of Physics, University of Ottawa; (GEOGCU) for the Department of Geography and Environmental Studies at Carleton University; (GEOGUO) for the Department of Geography at the University of Ottawa.

- \* F.P. Agterberg, *Geomathematics, Evaluation of Nonrenewable Resources, Automated Stratigraphic Correlation* (UO-Adjunct)
- \* R.W. Amott, *Clastic Sedimentology, Experimental Sedimentology* (UO)

- \* G.M. Atkinson, *Engineering Seismology, Strong Ground Motion, Seismic Hazard* (CU)
- \* G.E. Bauer, *Geotechnical Engineering, Groundwater Flow, Soil Mechanics* (CE)
- \* Keith Bell, *Isotope Studies, Petrology of Alkaline Rocks and Carbonatites, Geochronology* (CU)
- \* Keith Benn, *Structural Geology, Structural Petrology, Anisotropy of Magnetic Susceptibility, Basement Tectonics* (UO)
- \* R.G. Berman, *Metamorphic Petrology, Experimental Petrology* (CU-Adjunct)
- \* John Blenkinsop, *Mass Spectrometry, Geochronology, Isotope Geochemistry* (CU)
- \* G.F. Bonham-Carter, *Spatial Information Systems, Spatial Data Modelling* (UO-Adjunct)
- \* R.L. Brown, *Tectonics and Structural Geology* (CU)
- \* C.R. Burn, *Permafrost and Ground Ice, Yukon and Western Arctic* (GEOGCU)
- \* M.W. Caldwell, *Vertebrate Paleontology, Evolution, Systematics* (CU-Adjunct)
- \* E.M. Cameron, *Precambrian Geochemistry, Genesis of Gold Deposits, Exploration Geochemistry* (UO-Adjunct)
- \* S.D. Carr, *Cordilleran and Grenville Tectonics, U-Pb Geochronology* (CU)
- \* I.D. Clark, *Hydrogeology, Environmental Isotope Geochemistry* (UO)
- \* B.L. Cousens, *Igneous Petrology, Isotope Geochemistry* (CU-Adjunct)
- \* André Desrochers, *Carbonate Sedimentology and Diagenesis, Canadian Arctic* (UO)
- \* S.L. Cumbaa, *Vertebrate Paleontology and Paleocology* (CU-Adjunct)
- \* G.R. Dix, *Sedimentology and Stratigraphy, Emphasis on Modern and Ancient Carbonate Settings* (CU)
- \* O.A. Dixon, *Invertebrate Paleontology, Stratigraphy, Canadian Arctic* (UO-Adjunct)
- \* J.A. Donaldson, *Precambrian Stratigraphy and Sedimentology* (CU-Adjunct)
- \* Danielle Fortin, *Geomicrobiology, Environmental Geochemistry* (OU)
- \* A.D. Fowler, *Geochemistry, Archean Metavolcanic Belts, Non-linear Dynamics* (UO)
- \* H.M. French, *Permafrost and Periglacial Phenomena* (UO)
- \* William K. Fyson, *Structural Analyses in Metamorphic Terrains* (OU-Adjunct)

- \* Konrad Gajewski, *Climatology and Climatic Changes: Quaternary Paleocology*(GEOGUO)
- \* Marie-Anne Geurts, *Palynology and Geomorphology, Travertine*(GEOGUO)
- \* H.J. Gibson, *Subaqueous Volcanic Processes and Metallic Mineral Deposits*(CU-Adjunct)
- \* W.D. Goodfellow, *Geochemistry of Modern and Ancient Sediment-hosted Deposits, Mass Extinction* (UO-Adjunct)
- \* S.K. Hanmer, *Shear Zones, Progressive Strain, Grenville Problems* (CU-Adjunct)
- \* M.D. Hannington, *Economic Geology, Mineral Deposits* (CU-Adjunct)
- \* Keiko Hattori, *Isotope Geochemistry, Mineral Deposits, Archean Geology* (UO)
- \* Donald D. Hogarth, *Mineralogy; Igneous and Metamorphic Petrology; Alkaline Rocks* (OU-Adjunct)
- \* P.G. Johnson, *Glacial Geomorphology, Slope Mass Movements, Glacier Hydrology*(GEOGUO)
- \* D.J. King, *Remote Sensing, Vegetation Damage Assessment including Geobotanical Techniques, Geographic Information Systems*(GEOGCU)
- \* Thomas Kotzer, *Environmental Isotope Geochemistry; Hydrogeology; Radioisotopes*(OU-Adjunct)
- \* Ralph Kretz, *Mineral Chemistry, Metamorphism, Environmental Studies*(UO-Adjunct)
- \* Jarmila Kukalova-Peck, *Paleontology, Fossil Insects* (CU-Adjunct)
- \* A.E. Lalonde, *Petrology and Mineralogy of Plutonic Rocks* (UO)
- \* Bernard Lauriol, *Geomorphology* (GEOGUO)
- \* D.A. Leckie, *Clastic Sedimentology, Sequence Stratigraphy, Basin Analysis* (CU-Adjunct)
- \* A.G. Lewkowicz, *Permafrost Geomorphology, Hydrogeology, Effect of Global Change on Arctic Terrain* (GEOGUO)
- \* Yvan L'Heureux, *Non-linear Dynamics; Crystal Growth Modelling*(PHY)
- \* Joyce Lundberg, *Karst, Quaternary Studies, Geochronology* (GEOGCU)
- \* F.A. Michel, *Isotope Geochemistry, Groundwater and Permafrost Studies* (CU)
- \* R.T. Patterson, *Micropaleontology Specializing in Foraminifera*(CU)
- \* J.A. Percival, *Igneous and Metamorphic Petrology, Geochemistry, Structural Geology, Geochronology* (UO-Adjunct)
- \* R.H. Rainbird, *Precambrian Sedimentology and Stratigraphy* (CU-Adjunct)
- \* Giorgio Ranalli, *Rheology of the Earth, Geodynamics, Plate Tectonics*(CU)
- \* D.G. Rancourt, *Mössbauer Spectrometry, Mineralogy, Geobarometry, Geothermometry, Micas* (PHY)
- \* M.R. Robin, *Contaminant Hydrogeology, Geostatistics, Geomathematics* (UO)
- \* W.R. Roest, *Global Plate Tectonics, Potential Fields, Regional Geophysical Compilations, Continental Margin Development, Arctic Ocean and Adjacent Land Areas* (UO-Adjunct)
- \* C.J. Schröder-Adams, *Micropaleontology, Biostratigraphy, Paleocology, Foraminifera, Sequence Stratigraphy* (CU)
- \* G.B. Skippen, *Metamorphic Petrology, Aqueous Geochemistry* (CU)
- \* M.W. Smith, *Permafrost, Microclimate, Soil Freezing* (GEOGCU)
- \* R. Stern, *U-Pb-Th Geochronology; Secondary Ion Mass Spectrometry; Trace Element Geochemistry* (CU-Adjunct)
- \* R.P. Taylor, *Igneous Petrology, Mineral Deposits* (CU)
- \* J.K. Torrance, *Soil Chemistry, Clays, Oxide Minerals and Geotechnical Problems*(GEOGCU)
- \* Cees van Staal, *Sedimentary and Metamorphic Terranes in Europe and North America and Tectonic Evolution of the Appalachian Orogen*(UO-Adjunct)
- \* Jan Veizer, *Sedimentary Geochemistry, Carbonates, Diagenesis, Ores, Precambrian Sedimentology* (UO)
- \* D.H. Watkinson, *Metallic Mineral Deposits* (CU)
- \* P.J. Williams, *Soil Freezing and Geotechnical Problems, Cold Region Pipelines* (GEOGCU-Adjunct)

## Master of Science

### Admission Requirements

The normal requirement for admission to the program is an Honours B.Sc. degree, with at least high honours standing, in geology or a related discipline.

### Program Requirements

- \* A research thesis defended at an oral examination
- \* The equivalent of 2.0 credits, one of which may be at the senior undergraduate level

\* Public lecture on thesis results prior to the thesis examination

### Academic Standing

A grade of B- or better must normally be received in each course counted towards the master's degree.

### Doctor of Philosophy

#### Admission Requirements

The normal requirement for admission to the Ph.D. Program is an M.Sc. degree in Earth Sciences or a related discipline.

Students who show outstanding academic performance and research promise may be permitted to transfer to the Ph.D. program. A student requesting such a transfer must first successfully complete the Ph.D. comprehensive examination and the M.Sc. course requirements.

#### Program Requirements

\* A research thesis defended orally before an examination board which includes an external examiner

\* A comprehensive examination to include presentation of a thesis proposal and three areas chosen by the student's advisory committee and approved by the Director of the Ottawa-Carleton Geoscience Centre

\* A minimum of 1.0 credit at the graduate level. Additional courses may be prescribed by the thesis advisory committee

\* Public lecture on thesis results prior to the thesis examination

#### Residence Requirement

The normal residence requirement for the Ph.D. degree is at least four terms of full-time study.

#### Guidelines for Completion of Master's and Doctoral Degrees

Full-time students enrolled in the 5.0 credit M.Sc. program are expected to complete the program by the end of six terms, and part-time students by the end of six years. A thesis proposal and selection of the thesis committee should be completed by the end of the second term for both Ph.D. and M.Sc. students.

Full-time students enrolled in the 10.0 credit Ph.D. program are expected to complete the program by the end of four years, and part-time students by the end of eight years, with

the opportunity for extensions upon the recommendation of the supervisor and departmental supervisor of graduate studies. A comprehensive examination for Ph.D. students must be completed by the end of the first year.

#### Directed Studies Courses

Directed studies courses are not permitted as credit toward the graduate degree requirements. Such courses may be taken as extra to the minimum requirements for the M.Sc. or Ph.D. degrees.

#### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

Geology 67.501 (GEO5101)

##### Seminars in Earth Sciences I

One-term modular courses covering a spectrum of Earth Science topics and current research problems, ranging from the geology and geophysics of the solid Earth, to its surface environment and crustal resources. A minimum of four modules offered per term, three must be completed to obtain course credit. Choice of modules must be approved by the Centre Director. Course complements Geology 67.502.

Geology 67.502 (GEO5102)

##### Seminars in Earth Sciences II

One-term modular courses covering a spectrum of Earth Science topics and current research problems, ranging from the geology and geophysics of the solid Earth, to its surface environment and crustal resources. A minimum of four modules offered per term, three must be completed to obtain course credit. Choice of modules must be approved by the Centre Director. Course complements Geology 67.501.

Geology 67.511 (GEO5111)

##### Crystallography

Principles and techniques of X-ray crystallography; interpretation of X-ray photographs and application to the study of minerals.

Geology 67.512 (GEO5112)

##### Rock-Forming Minerals

Recent work on structure, chemistry and interrelationships of igneous and metamorphic rock-forming minerals. (To alternate with 67.513/GEO5113 or GEO5713)



Geology 67.513 (GEO5113)

**Mineralogy of Plutonic Rocks**

A seminar course reviewing the applications of mineralogical studies to the petrogenesis of felsic and mafic plutonic rocks. Topics include: structural state of feldspar minerals, applications to granitic rocks; chemical evolution of mica, pyroxene and amphibole minerals in plutonic bodies; phase relationships; review of the mineralogy of specific plutonic rock-types (e.g. anorthosites, syenites and hyperaluminous granites). (To alternate with 67.512/GEO5112)

Geology 67.513 (GEO5713)

**Minéralogie des Suites Plutoniques**

Un cours ayant pour but d'accentuer la contribution des études minéralogiques détaillées à l'élaboration de la pétrogénèse des roches plutoniques mafiques ou felsiques. Parmi les sujets couverts figurent: la mise en ordre des feldspaths, son évaluation et ses applications à l'étude des granites, l'évolution chimique des micas, pyroxènes et amphiboles, relations de phases ainsi qu'une revue de la minéralogie de suites plutoniques spécifiques telles que les anorthosites, les syénites et les granites hyperalumineux.

Geology 67.521 (GEO5121)

**Igneous Petrogenesis**

Concentration on one or more of: origin and differentiation of basaltic magma; origin of granites; computer modelling of partial melting and fractional crystallization; magmatism in time and space. Laboratory and lecture material linked together in project form. (Also listed as GEO5721)

Geology 67.521 (GEO5721)

**Pétrogénèse Ignée**

Un cours basé sur un (ou plusieurs) des thèmes suivants: origine et différenciation de magma basaltique; origine de granites; simulation par ordinateur de fusion partielle et cristallisation fractionnée; magmatisme en temps et en espace. Laboratoire et cours qui s'enchaînent sous forme d'un projet.

Geology 67.522 (GEO5122)

**Physical Volcanology**

The distribution, classification and physical characteristics of volcanos and other volcanic landforms; lava flows, tephra, breccias, and other rocks formed through volcanic activity. Volcanic environments; recognition of ancient volcanic features; case histories.

Geology 67.523 (GEO5123)

**Metamorphic Petrology**

Thermodynamics and kinetics of mineral reactions; metamorphic zones and isograds; mass transfer; regional and global aspects of metamorphism.

Geology 67.524 (GEO5124)

**Metallic Mineral Deposits**

Relationships of some metallic mineral deposits to igneous rocks; topics range from oxides and sulphides in and around intrusions to stratiform volcanogenic deposits. Course includes a field trip to northern Ontario and Quebec.

Geology 67.527 (GEO5127)

**Physical Processes in Igneous Petrology**

Lecture, reading and seminar course dealing with the physical processes responsible for generation, ascent, crystallization and cooling of igneous rocks. Topics covered include partial melting in the upper mantle and separation of the liquid; magma properties, structure, viscosity, temperature, density, and heat; magma processes, intrusion, extrusion, diffusion, convection types, assimilation, nucleation, and crystal growth; cooling of magmas, conduction, convection, permeability, vapour phase exsolution, meteoric water, development of spinifex, spherulites. These processes will be related to field examples wherever possible.

Geology 67.527 (GEO5727)

**Les Processus Physiques en Pétrologie Ignée**

Les processus responsables directement à la génération, l'ascension, la croissance et le refroidissement des roches ignées seront présentés dans les cours, les colloques et dans la discussion de la littérature récente. Les sujets suivants seront traités; fusion dans le manteau et la séparation du liquide; propriétés des magmas, la structure, la viscosité, la température, la densité et la chaleur; les processus magmatiques, l'intrusion, l'extrusion, la diffusion, la convection, la perméabilité, l'exsolution d'une vapeur, l'eau météorique, le développement de spinifex et les sphérulites. Les processus seront étudiés à l'aide d'exemples de terrain chaque fois que ça sera possible.

Geology 67.528 (GEO5128)

**Ores in Sediments**

Ore-forming processes in sediments and sedimentary rocks. The generation, transport and deposition of ore elements relative to processes such as redox traps, basin water expulsion, direct precipitation from seawater, and placer sedimentation are discussed in seminar format. All major sedimentary deposit-types are included. Prerequisite: An undergraduate course in mineral deposits.

Geology 67.530 (GEO5130)

**Dynamics of Sedimentary Systems**

Weathering, rivers, ocean and atmosphere, sedimentation and tectonism, basins and their

sediments, P-T evolution, compaction, diagenesis, brines and fluid dynamics, mineralization, rock cycle and evolution through geologic time.

Geology 67.531 (GEO5131)

### **Sedimentology and Stratigraphy**

Selected problems in sedimentary geology, emphasizing sedimentary structures, facies models and diagenesis. The application of modern techniques of stratigraphic, petrologic and statistical analysis.

Geology 67.532 (GEO5132)

### **Paleoecology**

Emphasis on marine fossils as paleoenvironmental indicators: effects of substrate type, energy conditions, light, temperature, biotic associates and other environmental factors on the occurrence and distribution of organisms and their fossil remains.

Geology 67.533 (GEO5133)

### **Advanced Micropaleontology**

Selected topics in micropaleontology covered in greater detail than in introductory micropaleontology. Areas addressed include the paleoecology, biogeography and biology of foraminifera and other microfossil groups, as well as their application to biostratigraphy and paleo-oceanography.

Geology 67.534 (GEO5134)

### **Fossil Fuels**

Petroleum, natural gas, coal and unconventional fossil fuels; their origin, occurrence, and evaluation in the light of current geological thought.

Geology 67.535 (GEO5135)

### **Carbonate Sedimentology**

Lectures and seminars will cover aspects of modern depositional systems, dynamic facies models, sequence stratigraphy, mineralogy, and diagenesis of carbonate sediments. The practical part of the course will consist of a field-laboratory project that integrates various techniques in carbonate sedimentology (mapping, petrography, staining, Cathodoluminescence, fluorescence, SEM)

Geology 67.536 (GEO5136)

### **Paleobiology**

Selected topics in paleobiology of marine fossils. Topics include extinctions, micro- and macro-evolutionary processes, long-term trends and cycles in the Phanerozoic, and functional morphology.

Geology 67.538

### **Marine Geology**

Development of ocean basins, physical and chemical oceanographic processes, paleoceanographic changes of watermass distribution and circulation patterns, interaction

between atmosphere and ocean, marine sedimentation, offshore seismic stratigraphy, marine habitats, marine instrumentation.

Geology 67.539 (GEO5139)

### **Glacial Sedimentology**

Systematic study of various glacial sedimentary environments and processes, with emphasis on the influence of geological substrate and regional drainage gradient on glacial erosion sediment characteristics and sediment distribution; significance of genesis of glacial sediments for stratigraphic correlations, mineral exploration, interpretation of environmental geochemistry, aggregate evaluation, and hydrogeology. Weekly two-hour lectures supported by slides and extensive video records of glaciers and glacial processes. Local field trips and one weekend field excursion to Quebec to observe interrelationships of sedimentary facies.

Geology 67.541 (GEO5141)

### **Permafrost Hydrology and Investigative Methods**

An examination of groundwater flow in permafrost regions. The importance of groundwater in the formation of various types of ground ice, and the effect of groundwater flow on permafrost distribution.

Geology 67.542 (GEO5142)

### **Environmental Geoscience**

A study-seminar course in which students will examine, in depth, certain environmental problems, including geological hazards, mineral and energy consumption and environmental degradation. The relation between development and the environment will be considered. Students will prepare a report and present a seminar on a subject of their choice, and will participate in a research project centred in the Ottawa area.

Geology 67.543 (GEO5143)

### **Environmental Isotopes and Groundwater Geochemistry**

Stable environmental isotopes ( $^{18}\text{O}$ ,  $2\text{H}$ ,  $^{13}\text{C}$ ,  $^{34}\text{S}$ ,  $^{15}\text{N}$ ) in studies of groundwater origin and flow, and geothermal studies. Groundwater dating techniques involving tritium and radio-carbon, and exotic radioisotopes (e.g.,  $^{36}\text{Cl}$ ,  $^{39}\text{Ar}$ ,  $^{85}\text{Kr}$ ). Low temperature aqueous geochemistry and mineral solubility with emphasis on the carbonate system. Some application to paleoclimatology will be discussed.

Prerequisite: Fourth-year hydrogeology (67.420 or GEO4192) or the equivalent.

Geology 67.544 (GEO5144)

### **Groundwater Resources**

Advanced topics in the exploration and development of groundwater resources, includ-

ing detailed aquifer response analysis. Examination of hydrogeology in arid and undeveloped regions will also be included.

Prerequisite: Fourth-year hydrogeology (67.420 or GEO4192) or the equivalent.

Geology 67.545 (GEO5145)

#### **Contaminant Hydrogeology**

A theoretical and applied course examining sources of groundwater contamination and mechanisms of transport. Inorganic, radioactive, and organic, biological contaminant behaviour will be discussed as well as regulations, monitoring methodologies, aquifer restoration and fundamental questions of high-level radioactive-waste disposal and municipal landfills.

Prerequisite: Fourth-year geochemistry or the equivalent, or permission of instructor.

Geology 67.546 (GEO5146)

#### **Numerical Methods in Hydrogeology**

Application of numerical methods in hydrogeological problem solving, including a review of governing equations, initial and boundary conditions, and both finite element and finite difference methods. Additional topics to be explored include particle tracking, Laplace and Fourier transforms, and stochastic methods.

Prerequisite: Fourth-year hydrogeology or permission of instructor.

Geology 67.547 (GEO5147)

#### **Geochemistry of Natural Waters**

Aqueous speciation, solubility of metals, minerals and gas, reaction kinetics and equilibria. Chemistry and dynamics of groundwaters and hydrothermal fluids.

Geology 67.548 (GEO5148)

#### **Theory of Flow and Transport in Porous Media**

Course designed for hydrogeologists and engineers who want in-depth understanding of the theory of fluid flow and solute transport through geological materials. Emphasis on porous media. Topics to be covered: types of fluids and porous media; saturated, unsaturated, and multi-phase flow; development of solute transport equations using continuum and stochastic approaches. One three-hour lecture per week, reading and problem-solving assignments plus final examination.

Prerequisites: Fourth-year hydrogeology, second-year calculus, and first-year statistics, or permission of the instructor.

Geology 67.551 (GEO5151)

#### **Precambrian Geology**

Problems of Precambrian geology, emphasizing classical and current studies in North America; comparative study of the Canadian Shield and other Precambrian shields; research

projects, field trips and petrologic studies of representative rock suites.

Geology 67.552 (GEO5152)

#### **Geology of Arctic Canada**

Origins and development of the principal geological regions of the Canadian Arctic. Emphasis on the Phanerozoic record but other topics or problems may be included.

Geology 67.553 (GEO5153)

#### **Applications of Spatial Information Systems to Geology**

This is a practical course in the application of PC-based geographic information systems to the analysis of regional geoscientific data. Spatial data capture, spatial data structures, spatial data analysis and modelling will be reviewed with reference to applications in mineral exploration, environmental and other problems. Students will undertake assignments and projects involving the use of a PC-based system.

Geology 67.557 (GEO5157)

#### **Tectonic Processes Emphasizing Metamorphism and Geochronology**

Applications of empirical, analytical and quantitative techniques to problems in regional geology and crustal tectonics; orogenic processes; heat and metamorphism; isotopic geochronology as applied to thermal history; derivation and interpretation of P-T-t paths; comparison of modern, Phanerozoic and Precambrian tectonic processes.

Geology 67.560 (GEO5160)

#### **Chemistry of the Earth**

An investigation of the geochemical constitution of the Earth and how the Earth has evolved. Topics will include meteorites and the early history of the Earth; chemical and isotopic constraints on the geochemical evolution of the crust and mantle; Earth models and their limitations.

Geology 67.562 (GEO5162)

#### **Physical Geochemistry**

Application of thermodynamics to geologic problems. Experimental study of mineral equilibria.

Geology 67.563 (GEO5163)

#### **Stable Isotope Geochemistry**

Mechanisms of isotope fractionation in nature; physical and chemical isotope fractionation, kinetic isotope effects. Variation of stable isotope ratios (hydrogen, carbon, oxygen and sulphur) in nature. Preparation techniques of natural samples for isotope analysis. Applications of stable isotopes to study magma genesis, ore genesis, nature of water and formation fluids and sedimentary environments.



Geology 67.566 (GEO5166)

### **Exploration Geochemistry**

Selected topics in applied geochemistry including: biogeochemical exploration; element mobilities in the surface environment; recent developments in data interpretation; quality control of geochemical data. Special attention to the use of geochemical methods for gold exploration and possible applications of stable and radiogenic isotopes to mineral exploration.

Geology 67.567 (GEO5167)

### **Hydrothermal Fluids**

Liquids, vapours, supercritical fluids as the agents of rock-water interaction and mass transfer in the crust. Phase relations in systems such as NaCl-H<sub>2</sub>O-CO<sub>2</sub> and thermodynamic constraints on geological fluids. Applications to mineral equilibria and the microscopic study of fluid inclusions.

Geology 67.568 (GEO5168)

### **Mineralized Hydrothermal Systems**

Geology of active geothermal systems, generation of hydrothermal fluids, geochemistry of hydrothermal fluids, stability and solubility of minerals in base-metal and precious-metal mineralization, interpretation of fluid inclusion data.

Geology 67.569 (GEO5169)

### **Radioisotope Geochemistry**

Nucleosynthesis; chemical differentiation of the Earth. Evolution of large scale reservoirs. Isotopic tracers (<sup>143</sup>Nd/<sup>144</sup>Nd, <sup>87</sup>Sr/<sup>86</sup>Sr, common Pb). Geochronology; fundamentals and application of Sm/Nd, Rb/Sr, U/Pb, K/Ar and Lu/Hf methods. Evolution of the solid Earth from the isotopic perspective. Precludes additional credit for 67.565 (GEO5165) (taken before 1997-98).

Geology 67.571 (GEO5171)

### **Physics of the Earth**

The physics and dynamics of the solid Earth: seismology; gravitational and magnetic fields, thermal state. Geophysical constraints on the structure and composition of the interior. Geodynamic processes.

Geology 67.572 (GEO5172)

### **Tectonophysics**

The physics of deformation; continuum mechanics approach (elasticity, strength, plasticity, viscosity), and micro-rheological approach (diffusion, dislocations, and flow mechanisms). Applications to tectonic processes.

Geology 67.573 (GEO5173)

### **Structural Geology**

Selected problems in structural geology treated in seminar and laboratory sessions. Emphasis

on interpretation of fabrics developed during synmetamorphic strain. Students investigate and report on individual projects.

Geology 67.574 (GEO5174)

### **Tectonics**

An investigation of the structural style of mountain belts and their tectonic setting; tectonics of Precambrian deformed belts.

Geology 67.575 (GEO5175)

### **Neotectonics**

An investigation of present day geological processes in a variety of plate boundary and intraplate settings. Topics will include analysis of island arcs, currently active mountain ranges in convergent plate boundary settings, and rift systems in both continental and oceanic settings. Consideration will be given to depositional basins, structure, magmatism, metamorphism and mineralization in these various settings.

Geology 67.576 (GEO5176)

### **Rock Microfabric Analysis**

An overview of rock fabric studies. Specific topics will include shape and lattice-preferred orientations of minerals, anisotropy of magnetic susceptibility fabrics, mode of development and evolution of fabrics with progressive deformation, fabric asymmetries, and textural and petrofabric criteria for determination of deformational mechanisms. The course will include a review of measurement techniques (U-stage, X-ray, anisotropy of magnetic susceptibility, image analysis), and of methods of statistical analysis (vector averaging, pole and inverse pole diagrams, orientation distribution function). Tectonic implications of fabric type distributions and fabric development will be stressed. The relationship between petrofabrics and seismic anisotropy will be discussed. The course may include one or more of the following: student seminars, reports based on bibliographic research or personal research, work on fabric of selected samples.

Geology 67.576 (GEO5776)

### **L'Analyse des Microfabriques**

Un regard sur l'étude de la fabrique des roches à l'échelle microscopique. Les sujets abordés comprendront: les orientations préférentielles de réseaux et de forme des minéraux, les fabriques d'anisotropie de susceptibilité magnétique, les modes de développement et d'évolution des fabriques lors de la déformation progressive, les asymétries entre fabriques et sous-fabriques, et les critères pétrographiques pour détermination des mécanismes de déformation. Les techniques de mesure des fabriques (platine universelle, anisotropie de susceptibilité magnétique, rayons-X, analyse d'image) et les méthodes

d'analyse statistique des données directionnelles (moyennes vectorielles, projections de pôles, diagrammes de densité, fonction de la distribution des orientations) seront discutées. La signification tectonique du développement et de la distribution spatiale des différents types de fabriques sera mise en évidence. Les relations entre pétrofabrique et anisotropie sismique seront aussi abordées. Ce cours comprendra un ou plus des travaux dirigés suivants: séminaires, rapports écrits basés sur une recherche bibliographique ou basés sur un travail personnel, mesures et analyses des fabriques des échantillons sélectionnés.

Geology 67.577F1 or W1

### **Engineering Seismology**

Seismological topics with engineering applications. Characterization of seismicity and seismic sources (areas and faults). Seismic hazard analysis. Empirical and theoretical modeling of strong ground motion in time and frequency domain.

Geology 67.581 (GEO5181)

### **Pattern Formation and Analysis**

The course examines the quantitative measure of texture, and current ideas of pattern formation in the earth sciences. Spatial series, patterns, textures and other distributions are investigated. Pattern formation, self-organization, and rhythmic processes are studied.

Geology 67.590 (GEO5190)

### **Directed Studies**

Directed reading and/or laboratory studies for 1.0 credit course, under the guidance of selected extramural or intramural directors. A written description of the project must be submitted for departmental approval prior to registration. This course does not count for credit toward the graduate degree requirements.

Geology 67.591 (GEO5191)

### **Directed Studies**

Directed reading and/or laboratory studies for 0.5 credit course, under the guidance of selected extramural or intramural directors. A written description of the project must be submitted for departmental approval prior to registration. This course does not count for credit toward the graduate degree requirements.

Geology 67.593 (GEO5193)

### **Field Studies**

Systematic investigations of geological problems, based on a minimum of fifteen days field work plus related library research and laboratory projects. Written report required.

Geology 67.594 (GEO5294)

### **Problems in Historical Geology and Geological Time**

Controversial ideas concerning the Earth and time; historical development of thought on the physical and biological evolution of the Earth. Understanding the stratigraphic column in regard to duration, age and correlation, including evidence from paleontology and sedimentology, particularly gaps in the succession and rhythmic or episodic events. Origin and nature of life; relationship between crustal events and evolution, including extinctions. Concepts and models in geology; responsibility of the geologist to humanity. Half-credit course given during fall and winter terms.

Geology 67.599 (GEO7999)

### **M.Sc. Thesis**

A thesis proposal must be approved by the research advisory committee by the end of the first year of registration.

Geology 67.699 (GEO9999)

### **Ph.D. Thesis**

A thesis proposal must be approved by the research advisory committee by the end of the first year of registration.

The following geography courses are included in the Centre's program:

*Department of Geography and Environmental Studies, Carleton University*

Geography 45.530W1

### **Soil Thermal and Hydrologic Regimes**

Characteristics of soil regimes, particularly in freezing soils, role of soil properties; analytical and numerical methods, including computer simulation.

Geography 45.532F1

### **Soil Thermal and Hydrologic Properties**

Instrumental techniques for investigation of hydrological and thermal processes near the Earth's surface, laboratory instrumentation and analysis of laboratory and field procedures in geotechnical science.

Geography 45.533W1

### **Periglacial Geomorphology**

Permafrost, its distribution and significance, seasonal ground freezing, ground thermal regime, physical, thermodynamic, and geotechnical properties of freezing and thawing soils, terrain features ascribable to frost action, and solifluction and patterned ground.

Geography 45.534W1

### **Aspects of Clay Mineralogy and Soil Chemistry**

The role of clay minerals in soils will be considered from a geotechnical and/or biological perspective.

Geography 45.583F1, W1, S1

**Remote Sensing and Image Analysis**

Radiometric, geometric and resolution characteristics of remotely sensed data, image processing algorithms, analysis of spectral, textural, and contextual image information, applications in vegetation mapping and environmental analysis.

*Department of Geography, University of Ottawa:*

GEG 5101

**Field and Laboratory Research Methods A**

GEG 5301

**Cold Regions Hydrology and Geomorphology**

Selected topics in the hydrology and geomorphology of cold regions. Emphasis on glacierized, periglacial, or nival environments. This course will alternate with GEG 5701.

GEG 5307

**Research Design, Modelling and Environmental Data Analysis**

Evaluation of the methodology of physical geography. Research and the role of modelling and advanced data analysis in contemporary research. This course will alternate with GEG 5707.

GEG 5503

**Méthodes de Recherche sur le Terrain et au Laboratoire B.**

GEG 5701

**Hydrologie et Géomorphologie des Régions Froides**

Thèmes en hydrologie et en géomorphologie des régions froides. Exploration approfondie des environnements glaciaires, périglaciaires ou nivaux. Cours offert en alternance avec GEG 5301.

GEG 5707

**Conception d'un Projet de Recherche, Modélisation et Analyse de Données Environnementales**

Évaluation des méthodes de recherche en géographie physique. Rôle de la modélisation et de l'analyse avancée des données dans la recherche contemporaine. Cours offert en alternance avec le GEG 5307.

GEG 7103

**Palaeoenvironmental Reconstruction and Climate Change**

Theories of environmental change in relation to natural and anthropogenically induced climate change. Techniques used in palaeoenvironmental reconstruction. This course will alternate with GEG 7503.

GEG 7107

**Northern Ecosystems**

Dynamics of northern ecosystems with particular emphasis on their sensitivity to climate variability and climate change. This course will alternate with GEG 7507.

GEG 7301

**Field and Laboratory Research Method C**

GEG 7503

**Reconstruction Paléoenvironnementale et Changement Climatique**

Théories des changements environnementaux mises en relation avec les changements climatiques d'origine naturelle ou d'origine anthropique. Méthodes utilisées dans la reconstruction paléoenvironnementale. Cours offert en alternance avec GEG 7103.

GEG 7507

**Ecosystèmes Nordiques**

Dynamique des écosystèmes nordiques en mettant l'accent sur leur sensibilité à la variabilité et au changement climatiques. Cours offert en alternance avec GEG 7107.

GEG 7703

**Méthodes de Recherche sur le Terrain et au Laboratoire D.**

GEG 7107

**Northern Ecosystems**

Dynamics of northern ecosystems with particular emphasis on their sensitivity to climate variability and climate change. This course will alternate with GEG 7507.

GEG 7301

**Field and Laboratory Research Method C**

GEG 7503

**Reconstruction Paléoenvironnementale et Changement Climatique**

Théories des changements environnementaux mises en relation avec les changements climatiques d'origine naturelle ou d'origine anthropique. Méthodes utilisées dans la reconstruction paléoenvironnementale. Cours offert en alternance avec GEG 7103.

GEG 7507

**Ecosystèmes Nordiques**

Dynamique des écosystèmes nordiques en mettant l'accent sur leur sensibilité à la variabilité et au changement climatiques. Cours offert en alternance avec GEG 7107.

GEG 7703

**Méthodes de Recherche sur le Terrain et au Laboratoire D.**



## School of Languages, Literatures and Comparative Literary Studies: German

Dunton Tower 1419  
Telephone: 520-5644

Director: R. Jeffreys

**Supervisor of Graduate Studies (German):**  
To be announced

Students currently enrolled in programs offered by the Discipline of German are governed by the requirements contained in the 1997-98 Graduate Calendar.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

German 22.510F1 or W1  
**Theory and Methodology of German Studies**

Fallstudien zur Rezeption fremdsprachlicher Literatur: Die Shakespearerezeption seit dem 18. Jahrhundert. Übersetzungen (Wieland, Schlegel/Tieck, Fried), Bearbeitungen (Keller, H. Müller, Strauß) und Wirkung Shakespeares in deutscher Literatur vom 18. zum 20. Jahrhundert.

German 22.515F1, W1  
**Theory and Methodology of German Studies**  
Proseminar in literaturwissenschaftlicher Methodologie, Theorie, Text, Interpretation.

German 22.516F1, W1  
**Theory and Methodology of German Studies**

Proseminar in germanistischer Linguistik. Methoden der Analyse und Beschreibung von Sprache und Kommunikation.

German 22.541F1 or W1  
**Genres in German Literature**  
Formen der Kurzprosa, u.a. R. Walser, Kafka, Musil, Brecht.

German 22.544T2  
**Theory and Methodology of German Studies**  
Erzählstrukturen im 20. Jahrhundert. Stile der "Vergangenheitsbewältigung" und "Selbstopräsentation" im modernen historischen Roman: Thomas Mann, Doktor Faustus, Günter Grass, Hundejahre, Christa Wolf, Kindheitsmuster. Diachronie und Gattungstypen der Intertexte. (Also listed as Comparative Literary Studies 17.581)

German 22.546F1 or W1  
**Genres in German Literature**  
Fromen der Lyrik vom Barock bis zur Moderne. Gattungsbezogene Untersuchungen zu deutscher Lyrik aus vier Jahrhunderten im Gegenspiel sich entwickelnder Thematik. Hauptformen: Epigramm, Sonett, Ode, Lied, Ballade, Elegie; Einzelgedichte sowie Zyklen und andere Großgebilde. Ansätze zu einer Gattungstheorie.

German 22.547F1 or W1  
**Genres in German Literature**  
Erzählprosa des 19. Jahrhunderts: Novelle, Erzählung, Roman, Autobiographie. Untersuchung ausgewählter Texte sowie Überlegungen zu Gattungsfragen und Erzählpraxis. Werke von z.B. Brentano, Eichendorff, Fontane, Goethe, Hauptmann, Holz, Keller, Kleist, Meyer, Stifter, Tieck.

German 22.549F1  
**Genres in German Literature**  
Satire, fantasy, and the poetics of scale: Musil, Bobrowski, (Kafka, Robert Walser).

German 22.553F1, W1  
**Prevalent Themes in German Literature**  
Literatur und die Diskurse des Körpers Krankheit und Gesundheit in literarischen Texten; Disziplinierung und Befreiung des Körpers durch textuelle Darstellung; Schreiben und Lesen in der Therapeutik; Literatur als Symptom. Texte: von F. Schiller, E.T.A. Hoffmann, G. Büchner, R.M. Rilke, Th. Mann, V. Stefan, D. Wellershoff, A. Muschg.

German 22.563T2  
**Period Studies**  
Literarische Gattungen des Mittelalters bis zur Schwelle der Neuzeit: Lyrik, Gnomik, Epik, Prosatext. Texte: Walther von der Vogelweide, Hartmann von Aue, Oswald von Wolkenstein, Heinrich Wittenwiler, Der Sachsenspiegel, Johannes von Tepl. Also offered at the undergraduate level, with different requirements, as German 22.430, for which additional credit is precluded.

German 22.567F1

**Period Studies**

Romantic Poetry: Novalis, Tieck, Eichendorff, Brentano and others.

German 22.568F1 or W1

**Period Studies**

Moderne Lyrik: Die hermetische Tradition von Rilke bis Atabay.

German 22.571F1 or W1

**Individual Authors**

Goethe im frhhen 19. Jahrhundert.

German 22.574W1

**Individual Authors**

Grimmelshausen Simplicissimus: Auslegungsversuche.

German 22.579F1, W1

**Drama des 20. Jahrhunderts**

Exemplarische Bhnenwerke des deutschsprachigen Raums seit Wedekind, mit einem Exkurs über das Hörspiel.

German 22.580T2

**Linguistic Topics**

Geschichte der deutschen Sprachwissenschaft. Ursprungstheorien (Herder), anthropologische Sprachtheorie (Humboldt), historische Sprachbeschreibung (Junggrammatiker). Einfluß Saussures auf Grammatikmodelle des Deutschen (Weisgerber, Glinz, Brinkmann, Heringer), Satzsemantik und Valenztheorie (v. Polenz), Sprachkompetenz (Coseriu).

German 22.581T2

**Linguistic Topics**

Geschichte der deutschen Sprache und literarischen Diskurse. Diachronische Betrachtung der deutschen Sprache und Literatur vom Mittelalter bis zur Gegenwart. Also offered at the undergraduate level, with different requirements, as German 22.412, for which additional credit is precluded.

German 22.582F1 or W1

**Linguistic Topics**

Mittelalterliches Deutsch: Kennzeichen der mittelhochdeutschen Literatursprache. Morphologische, syntaktische und semantische Strukturen. Ausgewählte Texte aus Epik und Lyrik.

German 22.584F1, W1

**Linguistic Topics**

Der deutsche Satz. Modelle deutscher Syntax. Die kommunikative Funktion deutscher Satzstruktur in der Schriftsprache des 19. und 20. Jahrhunderts. Also offered at the undergraduate level, with different requirements, as 22.403★, for which additional credit is precluded.

German 22.585T2

**Linguistic Topics**

Angewandte Linguistik im Deutschunterricht als Fremdsprache. Lehr- und Lernstrategien im Bereich von Phonetik, Grammatik, Semantik und Textgrammatik; Produktion und Rezeption von Texten.

German 22.586F1, W1

**Linguistic Topics**

Die Entwicklung des Nationalismus-Diskurses im 19. Jahrhundert. Programmatische Schriften, Reden, Flugblätter, Gedichte und andere relevante Dokumente, die den Nationalstaat förderten, beziehungsweise (ab1871) das Reich unterstützten. Also offered at the undergraduate level, with different requirements, as German 22.470, for which additional credit is precluded.

German 22.591F1, W1, S1

**Special Topic**

Tutorial

German 22.592F1, W1, S1

**Comprehensive Examination**

German 22.598F2, W2, S2

**Research Essay**

German 22.599F4, W4, S4

**M.A. Thesis**

## History

Paterson Hall 430  
Telephone: 520-2834  
Fax: 520-2819  
E-mail: grad\_history@carleton.ca

### The Department

Acting Chair of the Department, Deborah Gorham

Departmental Supervisor of Graduate Studies, Marilyn Barber

Associate Supervisor, Bruce Elliott

The Department of History offers programs of study leading to the Master of Arts degree in History, with concentration in the following areas: Canadian, American, British, modern French, modern Russian, international (diplomatic), medieval, and European intellectual and social history. It also offers a program of study and research leading to the Doctor of Philosophy degree in history with a concentration in Canadian or women's history.

### Master of Arts

#### Admission Requirements

The minimum requirement for admission to the master's program is an Honours bachelor's degree (or the equivalent) with at least high honours standing.

The Department offers no qualifying-year program; applicants with a general (3 year) degree may be considered for admission into the fourth year of Carleton's B.A. (Honours) program.

#### Program Requirements

Candidates may follow either a thesis or a non-thesis program, as follows:

\* History 24.588 or 24.589: a seminar or tutorial in the historiography of the appropriate country or area (1.0 credit)

\* History 24.500: a practicum in the applied uses of history (1.0 credit) Another graduate history seminar may be substituted for this course by students who have had extensive work-related experiences in some historical field.

\* A graduate history seminar in the student's major field of concentration (1.0 credit)

\* *Either* History 24.599: thesis (2.0 credits) *or*

\* History 24.598: research essay (1.0 credit) *plus* one additional seminar (1.0 credit), which may be chosen from those offered at the graduate or 400-level by the Department of History, by another department at Carleton University, or by the Department of History at the University of Ottawa

\* M.A. students are required to submit thesis or research essay proposals to the graduate supervisor early in their second term of full-time enrollment.

### Guidelines for Completion of Master's Degree

Full-time students are expected to finish all requirements for the degree except 24.598 or 24.599 during their first two terms of study; part-time students should do so during their first twelve terms of study. The research essay or thesis requirement is designed to take both categories of students an additional two or three terms, respectively.

### Language Requirements

All candidates are required to demonstrate a reading knowledge of a language other than English, the choice to depend upon the field of the candidate's thesis or research. For seminars dealing with sources not in English, a reading knowledge of the appropriate language will be required before acceptance into the program. Details may be obtained from the supervisor of graduate studies.

### Doctor of Philosophy

#### Admission Requirements

Applicants with an M.A. degree will be expected to have at least high honours standing. Applicants for the women's history program will be expected to have at least one of their earlier degrees in history.

An applicant with an Honours bachelor's degree who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Canadian Ph.D. program directly. Such candidates will be required to complete at least 15.0 credits.

### Residence Requirement

The normal residence requirement for the Ph.D. degree is a minimum of three years of full-time study after the B.A. (Honours) degree, or two years after the M.A. degree.



## Program Requirements

Candidates will be responsible for three fields: a major field (Canadian or women's history) and two minor fields. In the case of Canadian history majors, at least one of the minor fields must concern American, British, French, Russian, or international history. In the case of women's history majors, at least one of the minor fields must concern American, British, Canadian, French, Russian, or international history. Women's history majors must declare their area of concentration from among these fields. The second minor field for both majors may be a transnational topic or in a related discipline. In each instance, the minor field should cover approximately one century. Written examinations will be taken in the two minor fields before the end of the student's second term of study; an oral examination in the major field will be arranged during the student's fourth term. Ph.D. candidates are required to submit a thesis proposal to the graduate supervisor within *three* months of completing their oral examination.

A reading knowledge of French will be required. The language examination will be written early in the first post-M.A. year, and before the candidate is permitted to take the doctoral field examinations. Proven competence in an additional language may be required if it is pertinent to the candidate's program.

Students entering the 15-credit *Canadian history* program with a B.A. (Honours) will normally complete in their first year:

\* History 24.588

\* History 24.591

\* History 24.592

\* Two other graduate seminars

They will then join students entering the Canadian history program with a completed M.A. degree, who will normally be required to follow:

\* History 24.688

\* History 24.690: Preparation for a Ph.D. oral examination in Canadian history (equivalent to 2.0 credits)

\* Two of: History 24.610; 24.640; 24.650; 24.660; 24.693; an approved course of studies in a related discipline. At least one of these must be a national history other than Canadian (i.e. 24.610, 24.640, or 24.650).

Students declaring a major field in women's history will normally be required to follow:

\* History 24.688

\* History 24.692: Preparation for a Ph.D. oral examination in *women's history* (equivalent to 2.0 credits)

\* Two of: History 24.610; 24.640; 24.650; 24.660; 24.691: an approved course of studies in a related discipline. At least one of these must be a national history (i.e., 24.610, 24.640, 24.650, or 24.691).

With other requirements completed, doctoral students will be required to write a thesis on a topic related to Canadian or women's history (5.0 credits).

## Guidelines for Completion of Doctoral Degree

It is expected that full-time students will complete the thesis requirement within two years, and part-time students within four years.

## University of Ottawa

A Carleton University student may take one seminar in the Department of History at the University of Ottawa, with permission of the two departments.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

Admission to graduate seminars in the Department of History is normally restricted to graduate students in the Department and to others who have successfully completed two full upper-level undergraduate History courses, or the equivalent, in the general area of the seminar, or who have received permission of the Department.

History 24.500T2

### Practicum in Applied History

Study of the practical uses of history in such fields as teaching and methodology, archival management, museum research, oral history, journal editing, quantitative investigations, and contract research.

History 24.502T2

### Beginnings of Early Medieval Europe and Near East

Transformation of the later Roman world into the politics of early medieval Europe and

## History

Near East. Also offered at the undergraduate level, with different requirements, as History 24.402 or Classics 13.402, for which additional credit is precluded.

History 24.505T2

### **Law and Society in Medieval England**

Also offered at the undergraduate level, with different requirements, as History 24.405, for which additional credit is precluded.

History 24.506T2

### **Medieval Intellectual History**

An examination of selected aspects of medieval intellectual history. Also offered at the undergraduate level, with different requirements, as History 24.406, for which additional credit is precluded.

History 24.507T2

### **Galileo and His Age**

An intensive examination of the scientific and polemical works of the Italian physicist and astronomer Galileo Galilei (1564-1642). His life and thought are explored in the context of his medieval predecessors and of sixteenth- and early seventeenth-century science and philosophy in general. Special attention is given to the role of patronage, the Jesuits, biblical interpretation, and the circumstances that led to his trial and condemnation. Also offered at the undergraduate level, with different requirements, as History 24.407, for which additional credit is precluded.

History 24.525T2

### **Society and Culture in Canada, 1850-1939**

Changes to the structure and values of Canadian societies and their culture in the period of urban-industrial transition.

History 24.526T2

### **Perspectives on State Formation in Canada**

An exploration of selected problems of political history: the construction of official statistics, the language of governments, the invention of nationalisms, the making of political cultures, the autonomy of the state, the practices of bureaucrats, the political role of women, the encounter of the welfare state and families, the political economy of the state, communities and the state. Also offered at the undergraduate level, with different requirements, as History 24.426, for which additional credit is precluded.

History 24.529T2

### **History of Northern Canada**

A seminar on the regional history of the Canadian north, including both the provincial and the territorial norths. Topics include native peoples, culture contact, the fur trade economy, and resource frontier development. Canadian attitudes toward the north and the

concept of Canada as a "northern nation" are also examined. Also offered at the undergraduate level, with different requirements, as History 24.434, for which additional credit is precluded.

History 24.530T2

### **Canadian Immigration and Ethnic History**

An examination of immigration and ethnic history in a selected period between the eighteenth and twentieth centuries. Also offered at the undergraduate level, with different requirements, as History 24.424, for which additional credit is precluded.

History 24.531T2

### **French Canada Since Confederation**

A study of topics relating to the political and social history of French Canada and to problems of cultural duality.

History 24.532T2

### **Ontario in the Nineteenth Century**

History 24.533T2

### **Intellectual History of Canada**

An intensive examination of selected aspects of Canadian thought from the early nineteenth century to the present.

History 24.534T2

### **Problems of Growth and War in Canada, 1896-1921**

History 24.535T2

### **The Canadian Diplomatic Tradition**

An examination of the origins, evolution, context, and intellectual content of Canadian diplomatic practices and policies.

History 24.536T2

### **Science and Technology in the Canadian Experience**

An examination of the role and relationship of science and technology, including their social and engineering applications, in the Canadian historical experience. Also offered at the undergraduate level, with different requirements, as History 24.421, for which additional credit is precluded.

History 24.537T2

### **The Maritimes in Transition, 1870s to 1920s**

A seminar on social and economic themes. Also offered at the undergraduate level, with different requirements, as History 24.422, for which additional credit is precluded.

History 24.540T2

### **The Age of the American Revolution**

History 24.556T2

### **Historical Perspectives on Power**

An inquiry into historical analyses of politics in light of the current social philosophical conceptions of power and consciousness, with

reference to early modern England, and/or Canada in the nineteenth and twentieth centuries, and/or Latin America in the late colonial period, with particular emphasis on Mexico, depending on the instructor(s).

History 24.557T2

**Community in Early Modern England, 1450-1600**

History 24.558T2

**Culture and Society in Eighteenth- and Nineteenth-Century Britain: Selected Topics**

History 24.559T2

**Women in Nineteenth- and Twentieth-Century North America and Britain**

An examination of the role and image of women in the context of social and economic development and of the family in North America and Britain.

History 24.560T2

**Revolutionary Russia, 1898-1921**

An examination of various primary sources available for research on revolutionary Russia. A sound reading knowledge of Russian is required for admission.

History 24.562T2

**M.S. Gorbachev and the Collapse of the USSR**

A study of the main reasons for the collapse of the USSR, with emphasis on the CPSU, Soviet ideological presumption, and its participation in the international arena. The nature of the USSR in the 1980s and Gorbachev's attempts at sweeping reform and their consequences provide the setting for this study.

History 24.580T2

**Problems in International History**

History 24.588T2

**Historiography of Canada**

A seminar, primarily for graduate students in Canadian history, which examines the trends and methods of Canadian historical writing and the influences upon it.

History 24.589T2

**Historiography**

A course of directed studies, leading to an oral comprehensive examination, in one of the following fields:

*Modern France*

The intensive study of selected problems in the writing of modern French political and social history.

*Britain*

The intensive study of a range of selected problems in the writing of sixteenth-century or nineteenth-century English history.

*Modern Russia*

Concentrated reading in Russian history and historiography with emphasis on the nineteenth and early twentieth centuries.

*United States*

A course in which the trends and methods of historical writing on the United States will be examined.

*International History*

A course in which the trends and methods of historical writing on international history will be examined.

*Medieval History*

Historical method and historiography of an aspect of the Middle Ages.

*European Intellectual and Social History*

Intensive study of a selected topic in the writing of European intellectual or social history during the seventeenth, eighteenth, or nineteenth centuries.

History 24.591T2, S2

**Directed Studies in a Canadian Field**

A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

History 24.592T2, S2

**Directed Studies in a Non-Canadian Field**

A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

History 24.593F1, W1, S1

**Directed Studies in a Canadian Field**

A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

History 24.594F1, W1, S1

**Directed Studies in a Non-Canadian Field**

A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

History 24.595F1, W1

**Selected Topics in a Canadian Field**

A seminar in an area not covered by an existing graduate course.

History 24.596F1, W1

**Selected Topics in a Non-Canadian Field**

A seminar in an area not covered by an existing graduate course.

History 24.598F2, W2, S2

**M.A. Research Essay**

An examination of an approved topic in Canadian, American, British, modern French, modern Russian, international, or medieval history.



## History

History 24.599F4, W4, S4

### **M.A. Thesis**

A substantial historical investigation. The subject will be determined in consultation with the Department, and a supervisor will be assigned. The candidate will be examined orally after presenting his/her thesis.

History 24.610T2, S2

### **Directed Studies**

Preparation for a minor field examination in one of the following areas of modern European history: France, Russia, and international history.

History 24.640T2, S2

### **Directed Studies in United States History**

History 24.650T2, S2

### **Directed Studies in British History**

History 24.660T2, S2

### **Directed Studies in a Transnational Topic**

Preparation for a minor field examination in an area not covered in another doctoral course.

History 24.688T2

### **Historical Theory and Method**

A course primarily for doctoral candidates in history, offered in alternate years, in which current trends in historical theory and methodology will be examined.

History 24.690F4, W4, S4

### **Directed Studies in Canadian History**

A program of supervised reading with several instructors in preparation for the Ph.D. oral examination.

History 24.691T2

### **Canadian History Minor**

A program of supervised reading in Canadian history leading to a written comprehensive examination for doctoral students whose major field is women's history. Students will attend History 24.690 in the fall and winter terms.

History 24.692F4, W4, S4

### **Directed Studies in Women's History**

A program of supervised reading with several instructors in preparation for the Ph.D. oral examination in women's history.

History 24.693T2

### **Women's History Minor**

A program of supervised reading in women's history leading to a written comprehensive examination for doctoral students whose major field is Canadian history. Students will attend History 24.692 in the fall and winter terms.

History 24.699F, W, S

### **Ph.D. Thesis**

## Industrial Design

Mackenzie Building 3470  
Telephone: 520-5672  
Fax: 520-4465

### The School

**Director of the School,** To be announced

The School of Industrial Design does not offer a program at the graduate level. However, it does offer graduate-level courses which can be used towards a degree program in the School of Architecture and in the Department of Mechanical and Aerospace Engineering in the Faculty of Engineering. Members of the school are available to supervise graduate research.

The interests and capabilities of the faculty members lie in the following areas:

#### *User Studies*

Applications of ergonomics and anthropometrics in industrial design; study of users from a market perspective.

#### *Form Studies*

Form development in industrial design; computer-aided design in industrial design.

#### *Mass Production Studies*

Advanced manufacturing methods in industrial design; quality and product life of manufactured goods.

#### *Design Systems and Methods*

Research and development in systems and methods as they apply to industrial design.

#### *Contextual Studies*

Cultural, social and ethical issues in industrial design.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Industrial Design 85.500F1, W1

#### **Directed Studies in Industrial Design**

Reading and research tutorials.

Industrial Design 85.531F1, W1, S1

#### **Creative Problem Solving and Design**

This course outlines problem-solving processes and how they can be applied in engineering design. The student will be introduced to and be expected to practice various systematic and creative problem-solving techniques. The emphasis is on the student's learning methodologies rather than accumulating information. The techniques may be successfully applied in any engineering specialty. (Also listed as Engineering 88.561)

## Information and Systems Science

See the School of Mathematics and Statistics; Department of Systems and Computer Engineering; or the School of Computer Science

### The Committee

**Chair of the Committee,** To be announced

The program of graduate study and research leading to the degree of Master of Science in Information and Systems Science is offered by the Committee with the cooperation of the Department of Systems and Computer Engineering, the School of Mathematics and Statistics, and the School of Computer Science.

The purpose of the program is to provide training in the use and application of computers, to those who have not studied extensively in this field at the undergraduate level. The process of using the computer in problem-solving is stressed. The program is flexible, though individual concentrations are usually in one of three broad areas:

- \* computer applications in a particular field (e.g., communications, energy systems)
- \* algorithms and methodologies for solution of complex problems by computer (e.g., graph theory, operations research, optimization, simulation and modelling)
- \* computer methods and technologies (e.g., databases, software engineering, computer languages)

Close links are maintained with the scientific, industrial, and technological communities, and an effort is made to direct students to project work of current practical significance.

### Qualifying-Year Program

Applicants who have a general (3 year) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program. Refer to the General Regulations section of this Calendar for regulations governing the qualifying year.

### Master of Science

#### Admission Requirements

Applicants should have an Honours bachelor's degree, or equivalent, with at least high honours standing, in mathematics, engineering, physics, chemistry, computer science, operations research, experimental psychology, econometrics, management science, or a re-

lated discipline. Undergraduate preparation should include at least 2.0 credits in computing and a minimum of 3.0 credits in mathematics, at least one of which is at the third-year level or higher. In addition, the student is required to have some knowledge of quantitative applications, such as numerical analysis, simulation, operations research, etc.

Admission to the program will be made through one of the three participating departments. Since space and laboratory facilities will be provided by one of the departments, students should apply through the department with which they wish to be most closely associated.

#### Program Requirements

The normal program comprises 4.0 credits and a 1.5 credit thesis; additional requirements may also be stipulated, depending upon the individual student's background. With the approval of the Committee, students who have substantial work experience may be permitted to substitute, in place of the thesis, 1.5 credit courses, one of which must be a graduate project course.

Students must take at least 1.0 credit from the department in which they are registered, and at least 0.5 credit from each of the other two participating departments. Students must also take course Information and Systems Science 93.582.

Each student should consult with his/her faculty adviser in the selection of a course pattern related to his/her principal area of interest.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of his/her thesis.

Course work may be completed on either a full-time or part-time basis. Thesis research normally requires full-time residence at the University; however, a candidate may be permitted to carry out thesis work off campus provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the Committee.

#### Guidelines for Completion of Master's Degree

Full-time students in the M.Sc. in Information and Systems Science will normally complete the degree requirements in two years and part-time students within four years. In order to meet this goal, full-time students should ar-



range a thesis supervisor within the first term of study, and should try to complete the course requirements as quickly as possible.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

FW,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

### Information and Systems Science 93.582F1 Introduction to Information and Systems Science

An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queuing systems, optimization. (Also listed as Mathematics 70.582, Engineering 94.582, Computer Science 95.582)

Information and Systems Science 93.598F3, W3, S3

### M.Sc. Thesis in Information and Systems Science

(Also listed as Mathematics 70.598, Engineering 94.598, Computer Science 95.598)

## School of Mathematics and Statistics

### Undergraduate Courses

- 70.301 Real Analysis
- 70.302 Advanced Calculus
- 70.310 Modern Algebra
- 70.350 Mathematical Statistics
- 70.403 Functional Analysis
- 70.451 Probability Theory
- 70.452 Survey Sampling
- 70.453 Applied Multivariate Analysis
- 70.456 Non-Parametric Methods
- 70.457 Statistical Inference
- 70.458 Stochastic Models
- 70.459 Topics in Stochastic Optimization and Advanced Mathematical Modelling
- 70.470 Partial Differential Equations
- 70.471 Topics in Partial Differential Equations
- 70.473 Qualitative Theory of Ordinary Differential Equations

- 70.481 Topics in Combinatorics
- 70.482 Introduction to Mathematical Logic
- 70.483 Computable Functions
- 70.485 Theory of Automata
- 70.486 Numerical Linear Algebra
- 70.487 Game Theory
- 70.488 Graph Theory and Algorithms
- 70.496 Directed Studies

### Graduate Courses

- 70.507, 70.508, 70.517, 70.519, 70.552, 70.553, 70.554, 70.555, 70.556, 70.557, 70.558, 70.559, 70.561, 70.565, 70.567, 70.569, 70.571, 70.581, 70.583, 70.584, 70.585, 70.586, 70/95.587, 70.588, 70.589, 70.590, 70.591, 70.593

## Department of Systems and Computer Engineering

### Undergraduate Courses

- 94.303 Introduction to Real-Time Systems
- 94.310 Systems Analysis
- 94.333 Real-Time Concurrent Systems
- 94.351 Communication Theory
- 94.361 Microprocessor Systems
- 94.401 Operating Systems
- 94.405 Discrete Simulation and its Applications
- 94.445 Discrete Time Systems
- 94.457 Architecture of Computer Systems
- 94.460 Digital Communications
- 94.462 Introduction to Computer Communications
- 94.480 Software Engineering
- 94.481 Software Engineering Project
- 94.485 Computer Systems Design Laboratory

### Graduate Courses

- 94.501, 94.504, 94.505, 94/95.507, 94.511, 94.517, 94.518, 94.519, 94.521, 94.527, 94.531, 94.535, 94.538, 94.541, 94.542, 94.552, 94.553, 94.554, 94.558, 94.560, 94.561, 94.562, 94.563, 94.564, 94.565, 94.566, 94.567, 94.568, 94.569, 94.571, 94.573, 94.574, 94.576, 94.577, 94.579, 94.581, 94.583, 94.584, 94.596

## School of Computer Science

### Undergraduate Courses

- 95.300 Operating Systems
- 95.304 Software Systems Development
- 95.305 Database Management Systems
- 95.401 Distributed Computing
- 95.402 Computer Graphics
- 95.403 Transaction Processing Systems
- 95.407 Applied Artificial Intelligence
- 95.409 Introduction to Parallel and Systolic Computing
- 95.410 Multimedia Systems
- 95.413 Computer Security and Cryptography

*Graduate Courses*

95.501, 95.502, 95.503, 95.504, 95.505, 95.506, 94/  
95.507, 95.508, 95.509, 95.510, 95.511, 95.512,  
95.513, 95.514, 95.515, 95.516, 95.520, 95.522,  
95.524, 95.526, 95.528, 95.573, 95.574

Due to the interdisciplinary nature of ISS, a student will in some cases benefit by taking an undergraduate course at the 300- or 400-level as part of his/her program. Where a 300-level course is to be taken, it will be extra to the degree requirements, or else arrangements will be made to enrich the subject matter, normally through a directed study course with the professor. Students may include 1.0 credit at the 400-level in their program without penalty, with the approval of the Department. The 300- and 400-level courses listed here are those most likely to interest ISS students; see the *Undergraduate Calendar* for a complete list. Students in the program are prohibited from taking Computer Science 95.484 Design and Analysis of Algorithms due to overlap of course material with Information and Systems Science 93.582.

## Interdisciplinary Studies

Dunton Tower 2216  
Telephone: 520-2368  
Fax: 520-3985

### The Institute

**Director of the Institute**, Andrew Brook

**Associate Director and Coordinator of Directed Interdisciplinary Studies**, Charles C. Gordon

The Institute of Interdisciplinary Studies offers graduate level courses which can be used towards a degree program in another discipline.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registrarial Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

Social Sciences 03.510F1 or W1

#### **Researching Across Disciplines**

Focuses on cross-disciplinary research issues and methodological solutions to problems that arise in the dialogue among the sciences, humanities and social sciences.



## International Affairs

Paterson Hall, Level 2A  
Telephone: 520-6655  
Fax: 520-2889  
E-mail: international\_affairs@carleton.ca

### The School

**Director of the School, M.A. Molot**

**Associate Director, F.O. Hampson**

The Norman Paterson School of International Affairs, established in 1965 with the generous support of the late Senator Norman M. Paterson, offers a program of studies leading to the M.A. degree.

The program focuses on three themes:

- \* Conflict Analysis
- \* Development Studies
- \* Political Economy

The program affords students the opportunity to focus on Canada in international affairs through specialized courses related to each of these themes. The program also allows students to focus on international management issues relevant to governmental and non-governmental organizations and international enterprise. Attention is also paid to the role of international institutions, the foreign policies of other countries, and to selected regional studies. The School maintains close cooperation with the Institute of Central/East European and Russian-Area Studies, and with committees designed to encourage and coordinate faculty and student interests in Africa, Asia, and Latin America.

A specialized resource centre is located in the School and is staffed by a full-time information specialist. Students and faculty have access to a broad range of current bibliographic materials, using the resources of the national capital area as well as on-line computerized bibliographic services in foreign policy and international affairs. The School also participates in the Social Science Data Archives at Carleton, and students have access to a full range of data sets available from the Inter-University Consortium for Political Research, as well as the Canadian Institute of Public Opinion poll data and the Human Relations Area Files.

### Qualifying-Year Program

#### Admission Requirements

The qualifying-year program is designed to enable students with at least high honours

standing, but with an inadequate background in the disciplines relevant to the M.A. program, to make up deficiencies. Candidates with a high standing in a general (3 year) bachelor's degree, in a discipline closely related to international affairs, will be required to take five full qualifying-year credits before being eligible to enter the master's program. Those with a B.A.(Honours) degree in an unrelated discipline may be required to take at least three full qualifying-year credits before being eligible to enter the master's program.

Students in the qualifying year are encouraged to select a core theme. They may also wish to select an area emphasis and to take courses that will enable them, in the M.A. year, to engage in specialized study in the problems of a region having particular relevance to the core theme they have elected. Students should also take appropriate courses in order to prepare them to fulfil the language requirements of the M.A. program.

Admission to the qualifying year does not guarantee admission to the M.A. program. To be considered for admission to the M.A. program, students in the qualifying year are expected to achieve the equivalent of high honours standing. Students in the qualifying year are considered for admission to the M.A. program at the same time as other applicants; if qualifying-year students are not admitted to the M.A. program in the first round of admissions, subsequent decisions on their admission will depend on performance and the availability of space in the M.A. program.

### Guidelines for Completion of Qualifying Year

Candidates admitted to the qualifying-year program on a full-time basis must complete all requirements during the fall and winter terms after initial registration.

#### Program Requirements

##### *Conflict Analysis*

Students will normally enrol in Political Science 47.361★ and 47.365★, or 47.460. Students who have not already taken an introductory course in international politics should enrol in Political Science 47.260. Courses in anthropology, economics, geography, history, law, and sociology, among other disciplines, are recommended as well as courses concerned with alternative approaches to conflict and conflict resolution, and area studies.

##### *Development Studies*

Students will normally enrol in Economics 43.363★. Students who have not already taken an introductory economics course should

enrol in Economics 43.100. Courses related to development studies in anthropology, geography, history, law, political science, and sociology, among other disciplines, are recommended as well as courses concerned with international economics and politics, and comparative and area studies.

#### *International Political Economy*

Students will normally enrol in Political Science 47.361★ and 47.365★, or 47.460, and Economics 43.360★, or 43.361★ and 43.362★. Students who have not already taken an introductory economics course should enrol in Economics 43.100. Courses in anthropology, geography, history, law, and sociology, among other disciplines, are recommended as well as courses concerned with political economy, the state, economic history, and comparative and area studies.

### Master of Arts

#### Admission Requirements

The minimum requirement for admission into the master's program is a B.A. (Honours) degree in a discipline related to international affairs.

Under current practice, at least a high honours standing is normally required for consideration for admission to the program.

Applicants are encouraged to submit Graduate Record Examination aptitude test scores; in some circumstances, students may be required to submit GRE scores.

The Faculty of Graduate Studies and Research requires applicants whose native tongue is not English to be tested for proficiency in English, as described in Section 3.6 of the General Regulations of this Calendar (see p. 52.)

Candidates who lack the required background in international affairs will be expected to complete a maximum of two additional courses. Core seminar requirements are listed under program requirements for qualifying year.

In order to be considered for financial assistance, applications for admission to the School of International Affairs must be postmarked by January 15. Deadline for receipt of supporting documentation, i.e., letters of reference and transcripts, is February 15. Applications will be accepted after the January 15 deadline; however, such applications will not meet the financial aid deadline.

Students admitted to the *conflict analysis* core are strongly encouraged to complete a senior undergraduate course in conflict theory as

well as courses in the social sciences, history, and law before beginning their programs. Students who have not completed a senior undergraduate 0.5 credit course in conflict theory will be required to take such a course as part of their program requirements.

Students admitted to the *development studies* core must have completed an introductory economics course prior to entry into the M.A. program. Students are also strongly encouraged to complete an undergraduate 0.5 credit course in development economics before beginning the M.A. program. Otherwise, this requirement (additional to the M.A.) will have to be taken simultaneously with the M.A. program, and may result in some delay in its completion.

Students admitted to the *international political economy* core must complete an introductory economics course prior to entry in the M.A. program. Students are also strongly encouraged to complete undergraduate courses in political economy, international economics, and international politics, as well as courses in geography, history, law, and sociology before beginning their programs. Students who have not completed a course in international economics will be required to take International Affairs 46.538 as part of their program requirements.

#### Program Requirements

Students may follow either a thesis/research essay program or a course work program.

#### Thesis/Research Essay Program

The normal program requirements for M.A. students in international affairs are:

- \* One interdisciplinary core seminar or the equivalent selected from the following:  
International Affairs 46.500, 46.504, 46.515
- \* 2.0 approved course work credits in international affairs or related disciplines, if a student elects to write a thesis
- \* 3.0 approved course work credits in international affairs or related disciplines, if a student elects to write a research essay
- \* A thesis (equivalent to 2.0 credits) or a research essay (equivalent to 1.0 credit) involving original research on an approved subject in the field of international affairs
- \* Full-time students are expected to submit a thesis/research essay proposal by the end of January following their first term of study in the program; part-time students are expected to submit a thesis/research proposal after completion of half of their course requirements.

## International Affairs

\* An ability to read a second major international language, or a language appropriate to a student's major research interest

\* An oral comprehensive examination on the thesis or research essay in their general field of study to determine the candidate's ability to relate various disciplines to the study of international affairs

\* English-speaking Canadian students are expected to develop a proficiency in French,

### Course Work Program

\* One interdisciplinary core seminar selected as in thesis/research essay program;

\* Four approved courses selected as in thesis/research essay program excluding 46.598/46.599;

\* Language requirement as in thesis/research essay program;

\* An oral comprehensive examination (46.597F4, W4, S4) in the candidate's program and concentration to determine the candidate's ability to relate various disciplines to the study of International Affairs. The examination will normally be taken upon completion of course work requirements.

### Concentrations

Students in all three core seminars may, if they wish, choose to focus their studies on one of five concentrations as part of their overall program. The concentrations, designed to permit some specialization within the context of the M.A. degree, will be structured around particular sets of courses selected in consultation with a faculty adviser.

#### *Canadian Concentration*

This concentration focuses on Canadian policies and activities in international affairs. It will be of interest to students wishing to focus their studies on the formulation and implementation of Canadian foreign policy in the areas of international security, trade and investment, or development assistance. The concentration will include:

\* One of the three interdisciplinary core seminars

\* International Affairs 46.510

\* A thesis or a research essay on a Canadian theme

#### *Environment Concentration*

This concentration focuses on international aspects of the natural environment, including the relationship of the environment to development, environmental concerns of higher-

income countries, and global or planetary issues. The concentration will include:

\* One of the three interdisciplinary core seminars

\* One of International Affairs 46.570 or 46.571

\* A thesis or research essay on an environmental theme

#### *International Management Concentration*

Students may elect to include international management as part of their program in the School. This concentration will emphasize aspects of the international environment in which managers in the public and private sectors make decisions. It will be of particular interest to students who wish to pursue careers in international government and non-governmental organizations, international banking, and multinational enterprises. The concentration will be designed in consultation with a faculty coordinator and will include:

\* One of the three interdisciplinary core seminars

\* International Affairs 46.544

\* Courses from among those offered by the School of International Affairs, and by the Schools of Business and Public Administration

\* A thesis or a research essay on an international management theme

Students who have not completed a course in international economics will be required to take International Affairs 46.538 as part of their program requirements.

#### *North American Free Trade Agreement (NAFTA) Concentration*

This concentration focuses on the new trade, investment, and political relationships that are developing in North America with the implementation of the North American Free Trade Agreement, and the processes and implications of accession of other countries. The concentration will include:

\* One of the three interdisciplinary core seminars

\* International Affairs 46.536

\* A thesis or a research essay on a NAFTA topic

\* A demonstration of competency in Spanish

\* Courses chosen after consultation with a faculty adviser. Among those recommended are 46.530, 46.538, 46.539, 46.540, 46.544, 46.557, 46.564, 46.581



*Trade Policy Concentration*

This concentration emphasizes the formulation, administration, and consequences of trade and trade-related policies. It will be of interest to those who wish to pursue careers in the trade policy area. The concentration will include:

- \* One of the three interdisciplinary core seminars
- \* International Affairs 46.540
- \* A thesis or research essay on a trade policy theme

Students will require International Affairs 46.538 or the equivalent as a prerequisite for 46.540.

**Academic Standing**

A grade of B- or better must be obtained in each credit counted towards the master's degree. The School does not permit exceptions to this rule.

**Career Planning**

Students interested in continuing to doctoral programs should plan their programs to include courses in their discipline, if other than international affairs, which may be deemed necessary for their admission to doctoral programs. Interdisciplinary doctoral programs in international affairs are given in a number of institutions, and the faculty can provide guidance in planning for these programs.

Recent experiences of students show that a strong background in research methods and economics enhances job placement, and students may wish to take this into account in planning their course program.

School faculty can provide advice on careers in government, international governmental and non-governmental organizations, and in the private sector.

**Guidelines for the Completion of the Master's Degree**

Candidates can complete the M.A. program in twelve months of full-time study. However, most students require an additional one or two terms to complete the research essay or thesis requirement. Full-time master's students must complete all degree requirements within six terms of registered full-time study.

Part-time master's students must complete degree requirements within an elapsed period of six calendar years after the date of initial registration.

Students who elect to complete the program by a combination of full-time and part-time study are governed by the following elapsed time limitations: five calendar years if the candidate is registered as a full-time student for two or three terms and part-time for the balance; four calendar years if the candidate is registered for four or five terms as a full-time student and part-time for the balance.

These limitations are calculated from the date of initial registration in the master's program.

**Certificate in Health and Social Policy in Development**

The Norman Paterson School of International Affairs, in conjunction with the Canadian Association of University Schools of Nursing, the Centre for International Health and Development at the University of Ottawa, and the International Development Research Centre, offers a Certificate in Health and Social Policy in Development.

The Certificate program is intended for practitioners in the health and social policy fields who wish to upgrade or re-orient their careers with a focus on international development.

Students are advised to contact the School for information on admission and program requirements, course scheduling, and fee schedules.

**Master of Arts/Bachelor of Laws**

The Norman Paterson School of International Affairs and the Common Law Section of the Faculty of Law at the University of Ottawa offer a joint Master of Arts in International Affairs and Bachelor of Laws degree (M.A./LL.B.).

**Admission Requirements**

A student must make separate applications to the School of International Affairs at Carleton University and to the Faculty of Law at the University of Ottawa and be accepted by both institutions in accordance with the normal admission requirements of each program. Interest in pursuing the joint program must be specified in each application, and a joint committee will make a decision on admission to the joint program.

**Program Requirements**

A student will complete both the M.A. and the LL.B. programs over four calendar years. Students will be expected to fulfil the normal requirements of both the M.A. and LL.B. pro-

## International Affairs

grams. In addition, students in the joint program will be required to complete courses in international law to be specified by the Faculty of Law. The normal sequence of courses for the two degrees is as follows:

### *First Year*

\* Normal LL.B. first year

### *Second Year*

\* Normal M.A. first year (required course work to include a 0.5 credit course in international law)

### *Third Year*

\* Normal LL.B. second year, including 0.5 credit course from the School of International Affairs for which credit will be given in the LL.B. program;\*\* and spring/summer registration in M.A. research essay/thesis

### *Fourth Year*

\* Normal LL.B. third year, including 0.5 credit course from the School of International Affairs for which credit will be given in the LL.B. program;\*\* spring/summer registration, conclusion and defence of M.A. research essay/thesis

\*\* These two 0.5 credit courses in the School of International Affairs taken as credit toward the LL.B. will be additional to those required for the M.A. degree.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

Part-time students are permitted to enrol in a maximum of 1.0 credit per term.

## Core Seminars

International Affairs 46.500T2

### **Theories and Approaches to International Political Economy**

A study of global political economy, with emphasis on historical development, regional integration, and contemporary institutional structures.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

International Affairs 46.504T2

### **Theories and Issues in Development Studies**

This course examines the theoretical foundations of development policies and issues in international development. Its focus is on policy analysis. The range of seminar topics may change each year, and will address current topical issues on the international development agenda.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

International Affairs 46.515T2

### **Conflict Analysis**

A seminar comparing conflict theory drawn from strategic studies, peace research, and the social sciences, with applications to East-West conflict, regional conflicts, arms races and arms control, crisis management, and terrorism.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

## Other Courses

International Affairs 46.505F1 or W1

### **International Dimensions in Development Studies**

Issues in development financing, international trade, industrialization and technology transfer, food and natural resources, and the role of international organizations.

Note: Not open to students enrolled in 46.504.

International Affairs 46.506F1 or W1

### **Agriculture and Rural Development**

A study of the agricultural sector, rural areas, and rural welfare in developing countries, including consideration of structural change in agriculture, agrarian reform, rural development strategies in various countries, and public policies affecting agriculture, activities ancillary to agriculture, rural industry, and public service.

International Affairs 46.507F1 or W1

### **Theories of Development and Underdevelopment**

A comparative analysis of approaches to the study of development processes and underdevelopment, including structural-functional, neo-classical, Marxist, and dependency theories.

Note: Not open to students enrolled in 46.504.

International Affairs 46.508F1 or W1

### **Economic Development Policy and Planning**

Developing country policies and planning, and their impacts, including macro and sectoral techniques employed in development

planning, budgeting, and problems in development administration.

**Prerequisite:** Enrolment in the Development Administration stream of the M.A. program in the School of Public Administration, or permission of the School.

International Affairs 46.510W1

**Canada in International Affairs**

This course examines Canada's role in international affairs with special attention to issues of conflict and conflict resolution, international political economy, and international development. Both the content and formulation of Canada's international policies are analyzed.

**Prerequisite:** Enrolment in one of International Affairs 46.500, 46.504 or 46.515, or permission of the School.

International Affairs 46.511F1 or W1 or S1

**The Politics and Institutions of International Trade**

The course considers Canadian trade practice, places trade policy within the broader context of Canadian policy-making, and compares Canadian policy and practice to that in the United States, Europe, Japan, and the major developing countries.

**Precludes additional credit for International Affairs 46.549 (taken prior to 1997-98).**

International Affairs 46.521F1 or W1

**Theory and Practice of Arms Control**

This course explores the theoretical and analytical underpinnings of modern arms control, including nuclear non-proliferation issues in the post Cold War era with special emphasis on the impact of political, economic, technological and social-psychological factors on international security.

International Affairs 46.522F1 or W1

**International Security After the Cold War**

This course examines the evolving strategic and security environment in international relations after the Cold War, addressing both traditional and non-traditional concepts of national and international security. Topics discussed include new threats to security such as transnational crime, forced migration and international terrorism.

International Affairs 46.523F1 or W1

**International Mediation and Conflict Resolution**

This seminar explores various approaches to the management and resolution of international economic, political and security conflicts. These approaches may include arbitration, conciliation and mediation as well as less formal mechanisms for third party consultation and collaborative problem-solving.

International Affairs 46.527F1 or W1

**Middle East Economic and Political Relations**

A course on economic and political relations among countries of the Middle East. Emphasis will be placed on the peace process and arrangements for regional security and regional economic cooperation, among them the prospects for regional collaboration.

International Affairs 46.529F1 or W1

**Conflict in Southern Africa**

A critical examination of competing interpretations of conflict in southern Africa, including approaches to conflict resolution.

International Affairs 46.530F1

**Political Economy of Multinational Enterprises**

An appreciation of recent economic and political developments in the fields of international economics and industrial organization as they affect multinational enterprises. The course develops concepts and analytical approaches to examine the impact of multinational enterprises on international affairs and the implications for public policy.

International Affairs 46.532F1 or W1

**Science, Technology and International Affairs: The Advanced, Industrial Countries**

This seminar analyzes the process of technological change since the industrial revolution and examines its consequences for development in the advanced industrial countries and for relations among these countries.

International Affairs 46.533F1 or W1

**Science, Technology and International Affairs: The Third World**

This seminar focuses upon the problem of building indigenous technological capabilities in the Third World. It examines the role of MNCs in the transfer of technology, the generation of appropriate technologies locally and the role of the state in the formulation of technology policy for development.

International Affairs 46.534F1 or W1

**Agribusiness North and South**

Analysis of the transformation of agriculture into an integrated multi-sectoral food production system and of its theoretical implications. Focus on the growth and strategies of agribusiness institutions in advanced industrial societies and on their penetration into, and impact upon, Third World economies. (Also listed as Geography 45.558)



International Affairs 46.535F1 or W1

**International Bargaining and Negotiation: Theory and Practice**

An examination of bargaining and negotiation in international economic, political, and security issue areas, emphasizing case studies as well as theoretical analysis.

International Affairs 46.536F1 or W1

**Introduction to the North American Free Trade Agreement (NAFTA)**

An examination of the background to NAFTA, the negotiation of NAFTA and the side agreements, the provisions of NAFTA, the evolution of political, economic, and social relations in North America since the implementation of NAFTA, and the processes and implications of accession of other countries.

International Affairs 46.537W1

**Macroeconomics in a Development Context**

An examination of macroeconomic theory and policy in the context of the developing countries, with special emphasis upon theory and policy for open economies, structural adjustment to international disequilibrium, exchange rate and balance of payments management, fiscal and financial policy.

Prerequisite: Enrolment in the Development Administration stream of the M.A. program of the School of Public Administration, or permission of the School.

International Affairs 46.538F1 or W1

**International Trade: Theory and Policy**

This course examines the pure theory of international trade and selected policy issues. Topics covered include: theories of the pattern of trade; the gains from trade; the theory of distortions and welfare; and theories of endogenous trade policy formation.

International Affairs 46.539F1 or W1

**International Finance: Theory and Policy**

The course addresses the principles of open economy macroeconomics and international finance. The topics include exchange rate and output determination, balance of payments adjustment, and monetary and fiscal policy under different exchange rate regimes. The performance of the international monetary system is also analyzed.

International Affairs 46.540F1 or W1

**Trade Policy Analysis**

This course examines selected trade and trade-related policy issues. Topics are drawn from current policy debates, and may include: multilateral vs. preferential trade liberalization; standards harmonization as a precondition for free trade; and globalization and the rising skill wage premium.

Prerequisites: International Affairs 46.538 or the equivalent, M.A. standing in the Norman Paterson School of International Affairs, or permission of the School.

International Affairs 46.541F1 or W1

**International Financial Institutions and Policy**

An examination of institutional arrangements, international financial flows, and critical events in the field of international finance. The emphasis is on tracing the development and operation of international financial institutions, and how they have shaped modern financial markets, events, and policy.

Precludes additional credit for International Affairs 46.549 (taken prior to 1997-98).

International Affairs 46.542F1 or W1

**Territory and Territoriality**

Contemporary geographical and international relations theorizing is challenging conventional notions of boundaries and territories in the political organization of modernity. Using contemporary writings on geopolitics, security, sovereignty, self-determination and identity politics, this course investigates territoriality as a political and intellectual strategy. (Also listed as Geography 45.540).

International Affairs 46.544F1 or W1

**The Environment for International Management**

Analysis of the international economic environment for public and private sector managers. The course examines the growing economic interdependence of nations, the problems faced by managers and the effectiveness of emerging international rules and standards for trade, investment and intellectual property.

International Affairs 46.545F1 or W1

**International Organizations in International Affairs**

A critical analysis of the roles played by the United Nations and other international organizations in the field of international conflict, development, and political economy.

International Affairs 46.546F1 or W1

**Policy Analysis and Evaluation**

An examination of the international public policies of a number of countries, including Canada. The seminar focuses on various approaches to the policy process and examines case studies of the formulation and evaluation of economic, political, and security policies.

International Affairs 46.547F1 or W1

**International Relations Theory**

This course provides an overview of theories of international relations. Organized both his-

torically and conceptually, the course will examine a variety of theoretical approaches to international relations, among them the realist, liberal, structural, neo-realist, and critical perspectives.

International Affairs 46.548F1 or W1 or S1  
**Gender in International Affairs**

This course examines the role of gender differences in international affairs. It analyzes the concept of gender in the social sciences and considers feminist theories regarding war, nationalism, human rights, development, and the global economy.

Precludes additional credit for International Affairs 46.549R and S (taken prior to 1997-98).

International Affairs 46.549F1, W1, S1  
**Selected Topics in International Affairs**

International Affairs 46.555F1 or W1  
**International Law: Theory and Practice**

Examines various theoretical perspectives on international law and locates role international law plays in the international system. Topics include basis, creation and sources of international law, international dispute resolution, and international law and world order transformation. (Also listed as Law 51.563)

International Affairs 46.557F1 or W1  
**International Economic Law: Regulation of Trade and Investment**

Study of regulation of international economic relations. Discussion of international institutions, legal aspects of integration, governmental regulation of trade and investment. (Also listed as Law 51.520).

Prerequisite: Open only to graduate students in their master's year who have not previously studied international economic law.

International Affairs 46.560F1 or W1  
**Human Resource Development**

An analysis of theory and policy regarding some of the major areas of human development in the developing areas, including demography and population, education, public health, nutrition, women and development, social security, employment, and manpower planning.

International Affairs 46.561F1 or W1  
**Historical Dimensions of Development and Underdevelopment**

Comparative studies in the economic and social history of selected developed and developing countries. The aim is to identify conditions which have fostered or inhibited development in the past, and thereby to assess contemporary development strategies in the light of historical experience.

International Affairs 46.562F1 or W1  
**The Institutional Framework for International Assistance**

The course examines the policies and programs of governmental, non-governmental and multilateral organizations involved in international development assistance. Particular attention is paid to their political dynamics, strategic orientations, administrative operations, transfer mechanisms, operational priorities and developmental impact.

International Affairs 46.563F1 or W1  
**Issues in Development in Africa**

Analysis of structures and processes of political, social, and economic change in intertropical Africa at scales ranging from the intrahousehold and local community to the state and international system. An objective will be to integrate gender and the environment into analyses which draw on theories of political economy. (Also listed as Geography 45.520)

International Affairs 46.564F1 or W1  
**Issues in Development in Latin America**

An examination of the principal developmental trends, problems, and policies in the region as they have evolved since 1945. Emphasis will be given to the design and implementation of alternative developmental strategies in the future.

International Affairs 46.565F1 or W1  
**The Ethical Dimension of International Affairs**

This course critically examines the ethical dimensions of development, global conflict, and international political economy. Subject matter includes beliefs and values, rights and obligations, and individual and state morality.

International Affairs 46.567F1 or W1  
**Issues in Development in Southeast Asia**

This course offers a comparative analysis of the development experience of selected Southeast Asian countries. It addresses the processes of continuity and change in political culture, governance, economic management, social and environmental policy, and regional ASEAN relations. Attention is paid to historical and contemporary issues.

International Affairs 46.568F1 or W1  
**Indigenous Perspectives on Third World Development**

This course examines some of the major perspectives and theories on Third World Development which have emerged from within the Third World. Included are authors representing structural, dependency, and radical theories of development, as well as those who see development as psychological or spiritual liberation.

## International Affairs

### International Affairs 46.569F1 or W1 **Development Project Evaluation and Analysis**

An examination of social cost-benefit analysis and other micro-economic methods of project evaluation in the context of the project cycle in developing countries. Emphasis will be placed on policy analysis and implementation practice, case studies of development projects, including those of non-governmental organizations.

### International Affairs 46.570F1 or W1

#### **The Natural Ecosystem**

Analyzes human involvement in the natural environment as a development ecosystem. Discusses how the environment continues to be modified and its long term consequences due to rapid technological advances. Attention will be given to individual development projects including their political and social setting.

### International Affairs 46.571F1 or W1

#### **Global Environmental Change: Human Implications**

Global environmental change; its significance for societies, economies and international relations. Value systems underlying environmental discourse; political economy of the environment; sustainability and security. Environmental diplomacy and grassroots environmentalism. Regionalized impacts of pressures on natural environments; challenges of adaptation. (Also listed as Geography 45.505)

### International Affairs 46.575F1 or W1 or S1

#### **International Health, Social Policy and Planning**

This course focuses on health, social policy and planning in developing countries. Topics covered will include primary health care, the role of government in health administration, social policy formation, expenditure analysis in health and social factors, and techniques of policy evaluation in these sectors.

Precludes additional credit for International Affairs 46.549W (taken prior to 1997-98).

### International Affairs 46.580F1 or W1

#### **Asia Pacific Economic and Political Relations**

Addresses the evolving pattern of economic and political relations in the Asia-Pacific region. Topics will include security issues; trade and investment; and development cooperation. Particular consideration will be given to institutional arrangements, including ASEAN, APEC, AFTA and Canada's role in the regional affairs.

### International Affairs 46.581F1 or W1

#### **Regional Cooperation Among Developing Countries**

A comparative study of selected regional co-operation and integration schemes, including those in Africa, Asia, Latin America, and the Caribbean, as well as between higher and lower income countries.

### International Affairs 46.582F1 or W1

#### **The Political Economy of East-West Relations**

This course examines issues in the political economy of East-West relations. After a review of the Cold War period, the course will focus on aspects of the post-communist re-integration of the East European and former Soviet economies into the world economy.

### International Affairs 46.584F1 or W1

#### **International Relations in Europe**

This course examines international relations and organizations in Europe from theoretical and historical perspectives. Topics discussed include the origins and development of European organizations such as the European Union and the Organization for Security and Co-operation in Europe.

### International Affairs 46.588F1 or W1

#### **International Political Economy**

A seminar on the changing international division of labour, and its consequences for world politics. Topics include differing patterns of industrialization, colonial relations, the role of the state, and current issues in international political economy. (Also listed as Political Science 47.588).

Prerequisite: Work at a senior undergraduate level is required in at least two of the following: international relations, development studies, international trade, or political economy; or permission of the School.

Note: Not open to students enrolled in 46.500.

### International Affairs 46.591F1, W1, S1

#### **Tutorials in International Affairs**

To be chosen in consultation with the director.

### International Affairs 46.595F1, W1, S1

#### **Research Workshop**

This seminar focuses on the special problems of research design in the interdisciplinary field of international affairs, with materials drawn from both the established literature and the practice of leading members of the School's faculty.



International Affairs 46.597F4, W4, S4  
**Course Work Comprehensive in International Affairs**

Required for students in a course work M.A. who by the third term in their M.A. program have not yet completed their comprehensive examination. Completion of this course does not reduce the formal requirement of 5.0 credits.

International Affairs 46.598F2, W2, S2  
**Research Essay**

International Affairs 46.599F4, W4, S4  
**M.A. Thesis**

**Selection of Courses**

In addition to the graduate courses offered in the School, qualified students may choose from among courses in international affairs offered by related departments, schools, and institutes.

## Journalism and Communication

St. Patrick's Building 346  
Telephone: 520-7404  
Fax: 520-6690  
E-mail: journalism@carleton.ca

### The School

**Director of the School, Christopher Dornan**

**Supervisor of Graduate Studies (Journalism), C. McKercher**

The School of Journalism and Communication offers courses leading to the degree of Master of Journalism. (For a description of the degrees of Master of Arts and Ph.D. in Communication, see p. 231.) The emphasis in the M.J. program is on advanced professional education for those who are or intend to become practising journalists in the news media. In practical terms, this entails both the polishing of professional journalistic skills to a high level of proficiency and advanced education in a related field of study. Provision is made also for students who wish to undertake research in journalism and mass media.

Following a common first year of professional coursework, students in the master's program will choose one of three areas of concentration in their second year of study:

#### *Specialized Print Reporting*

At present, specializations are offered in the fields of politics/public administration, international affairs, and economics/business. Others may be added as resources become available.

#### *Broadcast Journalism*

The focus of this specialty will be the study of advanced techniques in reporting, writing and producing programs for the broadcast media.

#### *Journalism Studies*

This program is designed for applicants who have mastered the skills of reporting and writing for the news media but who wish to spend a year studying their craft and/or the news industry. This specialty encompasses a number of topics, which include the role of the media in society as it is conceived by selected social and political theorists, communications law, politics and the media, the economics of the media, and journalism history.

Carleton's School of Journalism and Communication is uniquely situated for advanced journalism study. It offers ready access to many of the people and institutions that most directly influence Canadian affairs: Parliament, fed-

eral government departments and agencies, embassies, business and labour organizations, and major economic and cultural institutions.

### Master of Journalism

#### Admission Requirements

The Master of Journalism program comprises 10.0 credits. Most applicants will be admitted to the First year of a two-year course of study, but some may qualify for admission directly to the Second year (see below). An admissions committee, including the supervisor of graduate studies, will determine the admissions qualifications of each applicant.

Admission will be selective. Admission will not be guaranteed to all who meet the published minimum requirements, as there are many more qualified applicants each year than there are available spaces.

A student who holds a bachelor's or master's degree from a recognized university in a field other than journalism may be admitted to the first year of study if he or she achieved at least high honours standing. Such students who complete the core first year, outlined below, and meet the requirements of the Faculty of Graduate Studies and Research, Section 11 of the General Regulations section of this Calendar (see p. 50), may proceed to Second year.

Applicants who have a three-year journalism degree with high honours standing may be admitted to a First year made up largely of approved courses from the Faculties of Arts and Social Sciences and Public Affairs and Management. Such students may proceed to the second year of study if they have achieved high honours standing.

A limited number of spaces will be made available for direct admission to the Second year of the M.J. program. Students must normally possess one of the following qualifications to be considered for this advanced admission: a B.J. (Honours) or the equivalent with high second-class standing, or a degree in another discipline from a recognized university plus at least five years of professional experience in journalism, or long and distinguished professional experience in journalism. Students with suitable professional qualifications but no degree may occasionally be admitted to a program in which they take a required number of undergraduate courses in addition to the M.J. program.

Application is made on forms available from the School of Journalism and Communication. Students applying for the first year of the program are advised to apply by June 1 as

enrollment in the School is limited. All applications received after June 1 will normally be considered only for entry into the program in the year following.

As a condition for graduation, all students are required to have a minimum of four months of practical experience in the media, and a working knowledge of a second language, preferably French.

## Program Requirements

### First Year

Candidates admitted to the first year of the Master of Journalism program must complete the following courses before proceeding to the second year of study:

- \* Journalism 28.500
- \* Journalism 28.520
- \* Journalism 28.522
- \* Journalism 28.526
- \* Journalism 28.528
- \* Journalism 28.541
- \* 1.0 credit of approved electives

First year M.J. candidates may be considered for advanced standing in certain of the above required courses, but in such cases will be required to replace waived courses with approved options.

### Second Year

Credits will be determined according to the stream pursued:

#### *Specialized Print Reporting*

- (i) Journalism 28.558
- (ii) Journalism 28.570
- (iii) Journalism 28.571
- (iv) Journalism 28.576
- (v) Journalism 28.598
- (vi) 1.0 credit of approved electives in the student's area of specialization

Note: Under special circumstances, and with the School's approval, a student could replace items (iv) and (v) and 0.5 credit elective in item (vi) above with a 2.0 credit M.J. Thesis, Journalism 28.599.

#### *Broadcast Journalism*

- (i) Journalism 28.558
- (ii) Journalism 28.572
- (iii) Journalism 28.573
- (iv) Journalism 28.576
- (v) Journalism 28.598
- (vi) 1.0 credit of approved electives in the student's area of specialization.

Note: Under special circumstances, and with the School's approval, a student could replace items (iv) and (v) and 0.5 credit elective in item

(vi) above with a 2.0 credit thesis, Journalism 28.599.

#### *Journalism Studies*

- (i) Journalism 28.500
- (ii) Journalism 28.550
- (iii) Journalism 28.599
- (iv) 2.0 credits related to the study of the media, chosen in consultation with the Supervisor of Graduate Studies.

## Academic Standing

All candidates are required to obtain a grade of B- or better in each credit in the program. A candidate may, with the recommendation of the School and the approval of the Dean of the Faculty of Graduate Studies and Research be allowed a grade of C+ in 1.0 credit.

Full-time students in a 10.0 credit M.J. program are advised that their thesis or research essay proposal must be formally approved within eighteen months of initial registration. Students in a 5.0 credit program must have the proposal formally approved by the middle of their second term of full-time registration. Due dates for part-time students will be adjusted accordingly. Students failing to file a proposal may not be permitted to register in subsequent terms until this requirement has been met. Approval of proposals shall be the responsibility of a thesis committee appointed by the Director of the School.

Students are advised to consult the General Regulations section of this Calendar for other regulations relating to academic standing.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

### First Year

Journalism 28.500F1 or W1

#### **Journalism and Society I**

An introduction to analysis of the news media in Western society, considering classical arguments and contemporary trends in the scholarly assessment of journalism practice.

Journalism 28.520F2

#### **Print Journalism Laboratory**

A laboratory course in basic reporting and



editing techniques, followed by application in the print media.

Journalism 28.522W2

### **Broadcast Journalism Laboratory**

A laboratory course in reporting and editing in the broadcast media.

Journalism 28.526F1, W1

### **Reporting Methods**

Topics covered will range from interviewing and observation skills to conducting a title search, lodging an access to information request and interpreting data.

Journalism 28.528F1, W1

### **Public Affairs Reporting**

A course devoted to understanding selected political, economic and social issues, and to analytical reporting on timely issues under professional conditions.

Journalism 28.535F1 or W1

### **Perspectives on Modern Society**

A seminar course examining texts from the social sciences, philosophy, literature, and journalism for the contribution they make to an understanding of issues facing modern industrial society.

Journalism 28.541F1 or W1

### **Journalism Law**

The purpose of this course is to prepare journalists to function comfortably within the legal and ethical guidelines governing their occupation. The course also aims to help them avoid the large errors in reporting legal matters. Topics studied and discussed include: the difference between civil and criminal law; contempt of court; free press, fair trial; revealing of sources; civil defamation; criminal libel; obscenity; copyright; privacy; government secrecy; advertising law.

## **Second Year**

Journalism 28.550F1, W1

### **Journalism and Society II**

A critical examination of the conduct of the news media, exploring the social, political and economic contexts in which the media work and assessing the consequences of journalism practice for contemporary society.

Prerequisite: Journalism 28.500 or permission of the School.

Journalism 28.558F1, W1

### **Professional Practices: Specialized Media**

A workshop course designed to give students instruction in specialized areas such as radio documentary, video documentary, film documentary, editing, magazine writing, photojournalism. Not all specialties will be offered each year. Also offered at the undergraduate level, with different requirements, as

Journalism 28.428★ for which additional credit is precluded.

Journalism 28.570T2

### **Advanced Reporting (Print)**

Students will explore and apply advanced journalistic principles and practices through a combination of readings, discussion and reporting in specific areas.

Journalism 28.571T2

### **Reporting and Online Publishing**

This course is designed to enhance reporting and editing skills through online publishing of electronic newspapers and/or newsmagazines.

Journalism 28.572T2

### **Television Journalism**

A seminar combining critical analysis of television journalism and practical skill development in television reporting, writing and production.

Journalism 28.573T2

### **Advanced Reporting (Broadcasting)**

Enhances television and radio reporting and production skills to include news features and mini-documentaries, preparation and presentation of public affairs programs, and multimedia delivery.

Journalism 28.576F1, W1

### **Professional Practices**

Students examine current journalism practices in a critical and analytical way, and explore ways of producing thorough and investigative journalism. Guest speakers share their expertise and skills.

Journalism 28.580F1 or W1

### **Survey Methods for Journalists**

An examination of basic research design and data collection with emphasis on problems of interpretation.

Journalism 28.588F1

### **Directed Readings**

Students, working under faculty direction, will undertake an intensive reading schedule in order to pursue a subject area of particular interest.

Journalism 28.589W1

### **Directed Research**

Students, working under faculty direction, will develop and undertake a research project in order to pursue a subject area of particular interest.

Journalism 28.590T2, S2

### **Directed Studies**

Reading and research tutorials.

Journalism 28.591F1, W1, S1

### **Directed Studies**

Reading and research tutorials.

Journalism 28.598F2, W2, S2

**M.J. Research Project**

The student will complete a substantial piece of public affairs journalism in print or, if resources permit, in radio or television; or a research project on the mass media; or a major contribution to journalism education through the production of a document on an aspect of journalism practice. Students in the specialized reporting stream will be expected to write on public affairs; broadcasting students will be expected to examine problems in broadcast journalism or, if resources permit, may be given an opportunity to submit a completed work on film or video or in radio.

Journalism 28.599F4, W4, S4

**M.J. Thesis**

To fulfill the requirements of this 2.0 credit thesis course, students must produce a major piece of journalistic research or complete an academic thesis in the area of journalism studies.

## Law

Loeb Building C473  
Telephone: 520-3690  
Fax: 520-4467

### The Department

**Chair of the Department, Michael Mac Neil**  
**Supervisor of Graduate Studies, Diana Majury**

The Department of Law offers a program of advanced study and research leading to a Master of Arts degree in Legal Studies. The program is open to full-time and part-time students.

The Department also offers a Graduate Certificate in Conflict Resolution.

The M.A. program provides an interdisciplinary, theoretical, and research-oriented approach to studying law as a social and political institution, with emphasis on the relationship between law and social transformation. The plan of studies includes a range of fields linked by a common theoretical and methodological concern with the way law shapes and is shaped by its social environment. The program is designed to develop the conceptual and analytical skills required for conducting independent research on law and society.

Within this context, students will focus on one or more of the following areas of specialization:

- \* Legal Theory and Social Theory
- \* Law, Crime and Social Order
- \* Women, Law and Gender Relations
- \* Political Economy of Law
- \* International and Comparative Legal Regimes
- \* Social History of Law

The location of the M.A. program in Legal Studies at Carleton provides students with a wealth of resources for research purposes. As well as the resources of the MacOdrum Library, students will have access to extensive Canadian and international research material through the Social Science Data Archives located at Carleton. The Library of the Supreme Court of Canada, the National Library, the National Archives, the Library of Parliament, Statistics Canada, and the Centre for Justice Statistics are all located in Ottawa. Ottawa houses many federal government departments and agencies, as well as the national headquarters of non-governmental organizations such as the Elizabeth Fry Society, the John Howard

Society, and the National Association of Women and Law. Many government departments and non-governmental organizations maintain specialized libraries, and offer access to documents and other research materials.

### Qualifying -Year Program

Applicants with exceptional promise who have less than B.A.(Honours) status may be admitted into a qualifying-year program designed to raise their standing to honours status. To be considered for admission into the master's program, students must obtain at least a high honours average in their qualifying-year courses.

### Master of Arts

#### Admission Requirements

The requirement for admission into the M.A. program in Legal Studies is an Honours bachelor's degree or the equivalent, with at least high honours standing.

Applicants will be considered for admission on the basis of their academic background and standing. Where relevant, previous professional experience may be taken into account.

Applicants without a background in law may be required to complete one or more designated courses, including Law 51.397: Legal Research Methods, from the department's undergraduate program before taking courses towards the master's degree.

The deadlines for submitting applications for graduate studies in the Legal Studies program are as follows: February 15 for students seeking financial assistance; July 1 for students not seeking financial assistance; November 1 for students who are seeking admission in January.

#### Program Requirements

In consultation with the supervisor of graduate studies, each candidate is required to complete the following program of studies:

- \* 3.0 credits
- \* A thesis equivalent to 2.0 credits and an oral examination

All students are required to take Law 51.500 and 51.501. These courses provide students with a common theoretical and interdisciplinary framework for the program. The methods course is designed to develop the link between the theoretical orientation and the important research component of the pro-



gram. Rather than seeking to provide all possible research skills, the course focuses on the importance of methodological issues and choices in research design.

In addition, students are encouraged to take 0.5 credit in a related discipline, in consultation with the supervisor of graduate studies.

All students must obtain satisfactory grades in their course work; make satisfactory progress in their research; maintain a close working relationship with their thesis supervisors; and attend seminars on current research and related topics. Each student will be required from time to time to present a seminar on his/her research.

## Thesis

The thesis must represent the result of the candidate's independent research undertaken after being admitted into graduate studies in the Department of Law. Previous work of the candidate may be used only as introductory or background material for the thesis.

A student may carry on research work related to the thesis off campus if the work is approved in advance and supervision arrangements have been made with the supervisor of graduate studies.

## Guidelines for Completion of Master's Degree

Full-time students are expected to complete the required two courses, Law 51.500 and Law 51.501, and an additional 2.0 credits by the end of the second term of registration. The thesis proposal should be submitted by the end of the sixth week of the second term of study. The thesis should be submitted by the end of the fourth term of study.

Part-time students are expected to complete the required two courses, Law 51.500 and 51.501, and an additional 2.0 credits by the end of their third year of study. The thesis proposal should be submitted by the end of the second month of the fourth year of study. The thesis should be submitted by the end of the fifth year of study.

## Certificate In Conflict Resolution

The Department of Law offers a program of advanced study leading to a Graduate Certificate in Conflict Resolution.

The Certificate provides an interdisciplinary program of study emphasizing theoretical models of conflict and its management and/or resolution, and integrating skills and techniques in the field. The program has an aca-

demic structure and a professional orientation, and is directed to individuals whose work involves negotiation or coping with conflict. The program develops in students an intellectual foundation and applied skills to enable them to function effectively in their field.

Interested students should contact the Department of Law for information concerning admission and program requirements, scheduled courses, and fee schedules.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

## Core Courses

The compulsory courses are designed to give substance to the major objectives of the program. They provide the theoretical and interdisciplinary framework which will set the terms of discussion and debate for the program. The courses are designated as compulsory because it is anticipated that students will be drawn from both law and social science backgrounds, and consequently there is a need to provide a central and shared basis for the whole program. The methods course is designed to develop the link between the theoretical orientation and the important research component of the program. Rather than seeking to provide all the research skills that students might require, the course focuses on the importance of methodological issues and choices in research design.

Law 51.500F1, W1 or S1

### Theories of Law and Social Transformation

Examines three groups of theories of law (liberal, sociological and Marxist) focusing on different ways law is conceived as an object of inquiry and on different accounts of trajectories of legal development. Potential of law for realizing or inhibiting social change provides analytic framework.

Law 51.501F1, W1 or S1

### Legal Method and Social Inquiry

Introduces problems of research strategy and methods. Explores contrasting methodologies in legal research; evaluates methodologies

employed in understanding legal reasoning, discourses, and practices. Includes seminars in which participants present outlines of their own research projects, focusing on methodologies and research questions.

Law 51.599F4, W4, S4  
M.A. Thesis

## Other Law Courses

Law 51.502F1, W1 or S1

### Law and Gender Relations

Examines theoretical approaches informed by significance of gender to structure and operation of law. Concepts such as essentialism, difference, cultural determination, and social construction of gender relations examined in context of contemporary feminist debates. Focus on understanding and facility with feminist analysis and methodology.

Law 51.503F1, W1 or S1

### Law, Economy and Society

Addresses the relationship between law, economy, and society. Competing theoretical accounts of the relationship between legal regulation and social and economic change explored through selected historical and contemporary case studies.

Law 51.504F1, W1 or S1

### Law, Crime and Social Order

Examines theoretical dimensions of relationship between law, state, crime, and social order. Explores scope and limitations of criminal justice system as an agency of social control. Examines shifts in forms of social order and their relation to changes in criminal law and sanctions.

Law 51.505F1, W1 or S1

### Law, State and Politics

Examines theoretical explanations of relationships between law, state and politics. Selected areas such as rights theory, rule of law, separation of powers or judicial review may provide focus.

Law 51.506F1, W1 or S1

### Historical Perspectives on Law and Society

Examines historical relationship between social forces, law and legal institutions and utility of historical forms of knowledge and methods to legal studies. Surveys selected issues in private, public and criminal law.

Law 51.507F1, W1 or S1

### Race, Ethnicity and the Law

Examines ways race and racism interact with gender and class in shaping legal system. Explores ways legal system institutionalizes racism and potential for using the legal system to combat racism. Selected areas such as immi-

gration law and native rights may be used to illustrate themes.

Law 51.508F1, W1 or S1

### Consuming Passions: The Regulation of Consumption, Appearance and Sexuality

Examines rise of consumption and private pleasures and their regulation and self-regulation. Social history of regulation of two fields of consumption: surfaces of the person: personal appearance, in particular of dress, the body, sexuality; and intakes of the body, focusing on food, alcohol, drugs. (Also listed as Sociology 53.524)

Law 51.510F1, W1 or S1

### Advanced Problems in Legal Philosophy

Studies in legal theory and analyses of law advanced by Hart, Dworkin, and others, and legal concepts: for example, principles, rights, duties, liability, etc. Precise course content will vary from year to year and will be announced at the beginning of the term. (Also listed as Philosophy 32.510).

Prerequisites: Either Law 51.315 or 51.311★ (Philosophy 32.311★) and Law 51.312★ (Philosophy 32.312★), or permission of the Department.

Law 51.520F1, W1 or S1

### International Economic Law: Regulation of Trade and Investment

Study of regulation of international economic activity. Discussion of relevant international institutions, legal aspects of integration, governmental regulation of trade and investment. (Also listed as International Affairs 46.557)

Prerequisite: Open only to students in their master's year who have not studied international economic law.

Law 51.532F1, W1 or S1

### Feminism, Law and Social Transformation

Exploration of nature and possibilities of feminist engagement with law. Policies and strategies of law reform and/or social transformation formulated and evaluated through application of theoretical frameworks to particular topics. Significance of Canadian Charter of Rights and Freedoms and human rights legislation is examined.

Law 51.535F1, W1 or S1

### Crime, Social Change and Criminal Law Reform

Examination of the ideological and practical consequences of criminal law reform and policy initiatives undertaken by the state. Specific reform proposals examined to illustrate possible alternate responses to social problems and the varying effects of these responses.

Law 51.540F1, W1 or S1

**Law, Economy and the Regulatory Process**  
Relationship between law, the economy, and the regulatory process. Examines models from political and economic perspectives, and impact of theories of regulation on regulatory practice and enforcement. Selected topics may be drawn from labour law, housing and consumer protection, environmental protection, and anti-combines legislation.

Law 51.545F1, W1 or S1

**Canadian Labour Law Policy from a Comparative Perspective**

Examines major influences on formation of Canadian labour law policy using a comparative perspective to highlight divergencies in Western democratic nations. Question if and why Canadian labour law is distinctive. Includes collective bargaining and regulation of individual employment relationships.

Law 51.550F1, W1 or S1

**The Canadian Constitution**

Familiarizes students with terminology, principles, and doctrines of judicial interpretation of Constitution Acts 1867-1982 and other constitutional statutes. Emphasis on division of legislative powers in the Canadian federation.

Prerequisite: Open only to graduate students in their master's year who have not previously studied Canadian constitutional law.

Law 51.553F1, W1 or S1

**Advanced Legal Problems of Federalism**

An advanced study of selected Canadian constitutional problems including constitutional revision. Some comparisons with other federal systems may be made.

Prerequisite: A course in Canadian constitutional law, for example Law 51.550, or permission of the Department.

Law 51.556F1, W1 or S1

**Advanced Administrative Law Problems**

An in-depth study of selected legal questions involving the activities of public authorities.

Prerequisite: A course in administrative law or permission of the Department.

Law 51.563F1, W1 or S1

**International Law: Theory and Practice**

Examines various theoretical perspectives on international law and locates role international law plays in the international system. Topics include basis, creation and sources of international law, international dispute resolution, and international law and world order transformation. (Also listed as International Affairs 46.555)

Law 51.590F1, W1 or S1

**Tutorials/Directed Readings in Law**

Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor.

Law 51.591F1, W1 or S1

**Tutorial/Directed Readings in Law**

Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor.

Law 51.593F1, W1 or S1

**Contemporary Topics in Legal Studies**

A research seminar which explores a selected topic from current debates in legal studies. Students should check with the Department regarding the topic offered.

Law 51.594F1, W1 or S1

**Contemporary Topics in Legal Studies**

A research seminar which explores a selected topic from current debates in legal studies.

### **Selection of Courses in Related Disciplines**

In addition to the graduate courses offered by the Department of Law, students in the M.A. program are encouraged to take 0.5 credit in a related discipline, in consultation with the supervisor of graduate studies. Courses offered by other academic units which can be taken towards the requirements of the M.A. in Legal Studies are listed below. This list is not exhaustive and is subject to change.

In certain circumstances (with the approval of the supervisor of graduate studies) up to 1.0 credit may be selected from among those offered at the 400-level.

*Note:* Students should be aware that the number of spaces in graduate courses offered by other departments may be limited, and that registration may be conditional upon obtaining the prior approval of the department concerned. It is the student's responsibility to ensure that permission is obtained from the appropriate department prior to registering in any of the department's courses.

Students are advised that there is no guarantee that all of these courses will be offered in any given year, or in any given term. 1.0 credit courses are scheduled over two terms and students interested in these courses must consult the graduate supervisor. Students should check the current University timetable to ensure course availability and schedule when planning their program.



## Law

### *Canadian Studies*

12.510, 12.520

### *Economics*

43.432 Competition Policy

43.533, 43.538, 43.543

### *Geography*

45.540, 45.541, 45.544

### *History*

24.459 Selected Problems in the History of  
Women and the Family: From the  
Industrial Revolution

24.532, 24.559, 24.588

### *International Affairs*

46.510, 46.535, 46.542, 46.545, 46.555, 46.557,  
46.588

### *Journalism and Communication*

28.541

### *Political Science*

47.407 The Politics of Law Enforcement in  
Canada

47.413 The State in Advanced Capitalist  
Societies

47.509, 47.511, 47.570, 47.573

### *Psychology*

49.514, 49.517, 49.523, 49.546

### *Public Administration*

50.502, 50.523, 50.536, 50.537, 50.551, 50.552,  
50.567, 50.568, 50.569, 50.584

### *Sociology and Anthropology*

53.453 Workshop in Criminology/Deviance

53.457 Workshop in Social Psychology

53.500, 53.502, 53.509, 53.511, 53.512, 53.513,  
53.514, 53.521, 53.530, 53.532, 53.536, 53.538,  
53.540, 53.541, 53.544, 53.545, 53.549, 53.567,  
53.568, 53.589

## Linguistics and Applied Language Studies

Paterson Hall 249  
Telephone: 520-2802  
Fax: 520-6641  
E-mail: linguistics@carleton.ca

### The School

**Director,** Ian Pringle

**Supervisor of Graduate Studies,** Devon Woods

The School of Linguistics and Applied Language Studies offers programs of study leading to the degree of Master of Arts in Applied Language Studies. Applied language studies may be distinguished by their focus on language learning, especially the acquisition of literacy and/or second languages, in a variety of contexts.

The program is geared largely towards practitioners in the field, and is aimed at enhancing their understanding of:

- \* discourse processes and social contexts for language use
- \* first and/or second language acquisition and development
- \* educational contexts for and testing of such acquisition

Concentration is possible in one of the following three fields:

- \* English as a second language
- \* the acquisition and development of writing abilities
- \* adult literacy

In addition, individual programs may be drawn up for students who are interested in the connection among any of these three fields.

Additional information may be obtained by consulting the supervisor of graduate studies.

### Qualifying-Year Program

Applicants who hold a 3 year degree with honours standing (at least *B* overall) may be admitted to the qualifying-year program. Normally, these students will be required to complete 5.0 credits in accordance with the advice of the graduate supervisor. At the end of the qualifying-year program, the School will determine the student's eligibility to enter the master's program.

### Master of Arts

#### Admission Requirements

The normal requirement for admission to the master's program is a B.A.(Honours) degree in a discipline involving the analysis of language or the study of language use or learning; or a 3 year B.A. in a relevant discipline together with a B.Ed. or C.T.E.S.L. Students must have achieved high honours standing (at least *B+* in related courses and *B-* overall) in their academic work. Relevant professional experience is also seriously considered in admissions decisions. In some cases substantial professional experience and related professional development may be accepted as an alternative to certain formal academic work. Students whose previous studies include little work relevant to applied language studies may be required to take up to two additional 1.0 credit courses for the master's degree.

#### Program Requirements

Students will establish their programs in consultation with an adviser from the School.

Each candidate will select one of the following program paths:

\* Linguistics and Applied Language Studies 29.552; 29.501; plus 2.0 credits from the School's graduate listing; and a master's thesis (29.599).

\* Linguistics and Applied Language Studies 29.552; 29.501; plus 3.0 credits from the School's graduate listing; and a research essay (29.598).

\* Linguistics and Applied Language Studies 29.552; 29.501; plus 4.0 credits from the School's graduate listing.

The choice of thesis, research essay, or credit program path will be made by the student, with the advice of the Supervisor. Relevant factors will include the student's academic goals, professional goals, and background knowledge.

Linguistics and Applied Language Studies 29.501 is normally to be taken in the first fall term after admission to the program.

Permission may be granted for enrollment in 1.0 credit offered in another department.

Graduate students may take the equivalent of 1.0 full credit at the senior undergraduate level, with the permission of the School adviser.

## Guidelines for Completion of Master's Degree

It is expected that students will progress steadily towards the completion of requirements for the degree. In particular, it is normally expected that:

\* a full-time student will complete 3.0 credits of course work within two terms of study, and an acceptable thesis proposal early in the third term of study; or 4.0 credits of course work within three terms, and an acceptable research essay proposal early in the fourth term; and all degree requirements within six terms of study

\* a part-time student will complete 3.0 credits of course work within three years of initial registration, and an acceptable thesis proposal early in the fourth year; or 4.0 credits of course work within four years, and an acceptable research essay proposal early in the fifth year; and all degree requirements within six years of initial registration

\* a student who registers in a combination of full-time and part-time study will, in consultation with an adviser, develop a schedule for completion of course requirements and a thesis or research essay proposal, consistent with times to completion stated above and with the overall time limits specified in the General Regulations section in this Calendar

## Academic Standing

A standing of B- or better must be obtained in each credit counted towards the master's degree.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

FW,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

Linguistics and Applied Language Studies 29.501F1 or W1 or S1

### Directions in Applied Language Studies

A survey of current research directions in applied language studies and an introduction to ongoing research in the School. The course introduces students to the scope of theory and practice in the field.

Linguistics and Applied Language Studies 29.521F1 or W1 or S1

### Language Classroom Research

Research into language learning in the classroom; methods for evaluating classroom practices and materials.

Linguistics and Applied Language Studies 29.522F1 or W1 or S1

### Curriculum Design in ESL

Current theory and practice in ESL curriculum design in the light of recent research in linguistics, psycholinguistics, sociolinguistics, and language acquisition studies.

Linguistics and Applied Language Studies 29.523F1 or W1 or S1

### Issues in English Language Training/Teaching

A research seminar to explore current issues in English language training/teaching.

Linguistics and Applied Language Studies 29.541F1 or W1 or S1

### Rhetoric and Argument in the Human, Social and Natural Sciences

The degree to which rhetorical considerations shape the construction of arguments within disciplinary communities. How disciplinary and socio-historical conditions shape scientific communities' criteria for what is accepted as persuasive. Also offered at the undergraduate level, with different requirements, as Linguistics and Applied Language Studies 29.441★, for which additional credit is precluded.

Linguistics and Applied Language Studies 29.542F1 or W1 or S1

### Learning Across the Disciplines: A Research Practicum

For practising teachers or graduate student teachers, or tutors. Theories about and research into the role of language in learning and pedagogic situations which optimize that relationship. Also offered at the undergraduate level, with different requirements, as Linguistics and Applied Language Studies 29.442★, for which additional credit is precluded.

Linguistics and Applied Language Studies 29.543F1 or W1 or S1

### Language in the Classroom

Learning through language; studies of the use of language (as a resource for education) in the classroom; methods for evaluating the effectiveness of classroom discourse practices.

Linguistics and Applied Language Studies 29.545F1 or W1 or S1

### Written Language, Representation and Cognition

Language and thought; social formation of mind and language; written and spoken dis-



course compared; models and taxonomies of written discourse; modes (narrative, exposition, argument) in traditional rhetoric and contemporary research; concepts of function and levels of abstracting.

Precludes additional credit for Linguistics and Applied Language Studies 29.563 (taken prior to 1997-98).

Linguistics and Applied Language Studies 29.551F1 or W1 or S1

### **Language Testing**

Methods for the development of tests; analytic techniques, including classical and IRT methods; research in test-taking and test evaluation.

Linguistics and Applied Language Studies 29.552F1 or W1 or S1

### **Inquiry Strategies in Applied Language Studies**

A consideration of various approaches to the design of studies and the collection and analysis of data. Naturalistic and quasi-experimental methods will be discussed. The role of statistics in disciplined inquiry, including an introduction to elementary procedures.

Linguistics and Applied Language Studies 29.554F1 or W1 or S1

### **Evaluation in Applied Language Programs**

An examination of various evaluation paradigms and their application to problems of program and curriculum in applied language settings; the connections among and differences between research and evaluation models of inquiry.

Linguistics and Applied Language Studies 29.558F1 or W1 or S1

### **Critical Applied Linguistics**

Approaches and methods of critical applied linguistics, including historical analysis, accounts and narratives, and discourse analysis. Application to areas such as language and gender, language in education and language policy. Prerequisite: Honours courses in linguistics or permission of the School.

Linguistics and Applied Language Studies 29.561F1 or W1 or S1

### **Language Acquisition**

Current models of first and second language acquisition, with emphasis on empirical studies. Also offered at the undergraduate level, with different requirements, as Linguistics and Applied Language Studies 29.462★, for which additional credit is precluded.

Linguistics and Applied Language Studies 29.564F1 or W1 or S1

### **Aspects of Language Development**

Empirical study of the development of syntax and the expansion of communicative com-

petence during the years of formal education; pedagogical implications.

Linguistics and Applied Language Studies 29.565F1 or W1 or S1

### **Writing Research and Theory: Overview of Recent and Current Approaches**

Overview of trends and directions in composition research and theory since the 1970s, from the reinvention of rhetorical theory, to the application of cognitive models in research on composing, and the more recent importation of social constructivist paradigms.

Linguistics and Applied Language Studies 29.566F1 or W1 or S1

### **Adult Literacy Acquisition**

Studies of adult literacy learners; theories of adult learning; relations between literacy and other linguistic abilities; pedagogical implications.

Linguistics and Applied Language Studies 29.571F1 or W1 or S1

### **Aspects of Bilingualism**

Aspects of the psycholinguistics and sociolinguistics of bilingualism.

Prerequisite: Honours courses in linguistics or permission of the School.

Linguistics and Applied Language Studies 29.573F1 or W1 or S1

### **Academic and Workplace Genres**

Overview of current reconceptualizations of genre as social action; recent research into the nature of school-based, professional, and workplace discourse; issues relating to genre acquisition and pedagogy.

Linguistics and Applied Language Studies 29.574F1 or W1 or S1

### **Research in Adult Literacy**

Studies in adult reading; methods of identifying adult reading needs; sociolinguistics of adult reading.

Linguistics and Applied Language Studies 29.575F1 or W1 or S1

### **Second Language Writing: Research and Theory**

Second language writing: research, theory, and pedagogy.

Linguistics and Applied Language Studies 29.576F1 or W1 or S1

### **Writing Research and Theory: Social and Cultural Dimensions**

Recent research in the social and cultural dimensions of learning to read and write; the uses and impact of written discourse in social contexts; writing in modern societies; the impact of electronic technology.

Precludes additional credit for Linguistics and Applied Language Studies 29.572 (taken prior to 1997-98).

## **Linguistics and Applied Language Studies**

Linguistics and Applied Language Studies  
29.577F1 or W1 or S1

### **Language Policy and Planning**

Analysis of interaction of political, social and cultural factors in the planning and implementation of language policy, with particular emphasis on the case of English in a selection of socio-political contexts.

Prerequisite: Honours courses in linguistics or permission of the School.

Linguistics and Applied Language Studies  
29.592F1 or W1 or S1

### **Tutorial in Applied Language Studies**

A one-term tutorial to study applications of linguistics in such areas as first-language education and second-language teaching.

Linguistics and Applied Language Studies  
29.595F1 or W1 or S1

### **Special Topics in Applied Language Studies**

Exploration of a topic from current research in applied language studies. Students should check with the School regarding the topic addressed in any term.

Linguistics and Applied Language Studies  
29.597T2

### **Tutorial in Applied Language Studies**

A two-term tutorial to study applications of linguistics in such areas as first-language education and second-language teaching.

Linguistics and Applied Language Studies  
29.598F2 or W2 or S2

### **Research Essay**

Linguistics and Applied Language Studies  
29.599F4 or W4 or S4

### **M.A. Thesis**

# Mass Communication

St. Patrick's Building 310  
Telephone: 520-7408  
Fax: 520-6690

## The Program

**Associate Director,** Paul Attallah

**Supervisor of Graduate Studies,** Vincent Mosco

## Master of Arts

The Mass Communication program of the School of Journalism and Communication offers a program of studies leading to a Master of Arts degree in Communication. Courses covering four areas of concentration are offered:

- \* the history of communication and media systems
- \* communication/information technologies and society
- \* communication and social relations
- \* communication policy and political economy

Additional information may be obtained by consulting the supervisor of graduate studies.

## Qualifying-Year Program

Applicants who lack an Honours degree, but have a 3 year degree with honours standing (a minimum B standing overall) may be considered for admission to a qualifying-year program. Students who complete the qualifying year with high honours standing may be considered for admission to the master's program in the following year. Refer to the General Regulations section of this Calendar for regulations governing the qualifying year.

## Admission Requirements

The minimum requirement for admission to the master's program is a B.A.(Honours) degree or the equivalent, with high honours standing in communication or a related discipline. Related disciplines may include sociology, political science, film studies, and Canadian studies.

Applicants without a background in communication studies may be required to take certain designated courses from the undergraduate mass communication program in addition to their regular program.

Possession of the minimum entrance standing is not in itself, however, an assurance of admission into the program.

## Program Requirements

Each student, in consultation with the supervisor of graduate studies, will be required to follow a thesis or a non-thesis program for a total of 5.0 credits. Two of the four areas of concentration must be chosen.

In selecting their program of studies, all students will be required to take Communication 27.511. Students may take one optional course (1.0 credit) outside the program, with permission of the supervisor of graduate studies.

All master's students are required to complete:

- \* Communication 27.511
- \* 1.0 credit selected from: Communication 27.521, 27.523, 27.525, 27.531
- \* a thesis (2.0 credits) and 1.0 credit from the list of optional courses below, or a research essay (1.0 credit) and 2.0 credits chosen from the list of optional courses

## Optional Courses

- \* Communication 27.555
- \* Communication 27.556
- \* Communication 27.557
- \* Communication 27.558
- \* Communication 27.559
- \* Communication 27.565
- \* Communication 27.589
- \* Communication 27.590

*Note:* Students may take up to 1.0 credit outside the program with permission of the supervisor of graduate studies.

## Academic Standing

A standing of B- or better must be obtained in each credit counted towards the master's degree.

## Doctor of Philosophy

The School of Journalism and Communication offers a program of studies leading to the Doctor of Philosophy degree in Communication. The program focuses on three fields of concentration:

- \* The history of communication
- \* The political economy of communication
- \* The socio-cultural analysis of communication



## Admission Requirements

The normal requirement for admission into the doctoral program is a master's degree (or the equivalent) in communication or a cognate field such as journalism studies, with an overall average of B+ or better.

Applicants who have deficiencies in certain areas may be admitted to the Ph.D. Program, but will normally be required to complete additional course work.

## Program Requirements

Doctoral candidates must successfully complete the equivalent of 10.0 credits. The specific requirements are as follows:

- \* Communication 27.600 (1.0 credit)
- \* 2.0 additional credits from the list of optional courses below; up to 1.0 credit may be taken in a relevant discipline outside of the School
- \* Comprehensive examinations (2.0 credits)
- \* A thesis (5.0 credits) which must be defended at an oral examination
- \* A language requirement as stated below

## Optional Courses

All doctoral candidates must complete 2.0 credits of optional courses from the list of approved options below. Students are encouraged to take up to 1.0 credit from courses offered in other departments, particularly those that address central theoretical and/or methodological issues within the student's chosen field of concentration. Students are also encouraged to choose directed readings/research courses with the core faculty of the program.

- \* Communication 27.521
- \* Communication 27.523
- \* Communication 27.525
- \* Communication 27.531
- \* Communication 27.555
- \* Communication 27.556
- \* Communication 27.557
- \* Communication 27.558
- \* Communication 27.559
- \* Journalism 28.541
- \* Journalism 28.550

## Comprehensive Examinations

Once doctoral candidates have successfully completed all course requirements, maintaining a GPA of 9.0 or better, they will proceed to the comprehensive examinations. The comprehensive requirement normally consists of two examinations equivalent to 2.0 credits. Both examinations must normally be completed no later than two years or six terms after initial full-time registration, or four years or 12 terms after initial part-time registration. Students who do not fulfill this requirement may be asked to withdraw from the program.

The first examination tests the student's mastery of the theoretical, methodological and substantive issues of the discipline as a whole. Students complete a written examination, covering all three fields of specialization in the program, which will be determined and graded by the instructors of Communication 27.600. Submission of the written examination is followed by a comprehensive oral examination, which is not restricted to issues raised by the written portion. Students who fail the examination will normally be asked to withdraw from the program.

The second examination tests the student's knowledge of one field of specialization. The student normally will write answers to a set of field questions and will defend these answers before the student's advisory committee.

## Language Requirement

Students are required to demonstrate an understanding of a language other than English, preferably French. Language testing will be administered by the School and will normally include a demonstration of reasonable understanding, on sight, of material contained in selected samples of scholarly literature in a foreign language and in the field of communication.

## Thesis Requirement

A thesis proposal is presented after the comprehensive requirement has been satisfied, and defended at an oral presentation. The thesis, normally equivalent to 5.0 credits, must be successfully defended at an oral examination.

## Academic Standing

A standing of B- or better must be obtained in each course counted towards the Ph.D. Degree. Students are advised to consult the General Regulations section of the Graduate Calendar for details of regulations governing graduate programs.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by '1'. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit.

Communication 27.511F1/2

### **Foundations of Communication Studies**

This course undertakes an examination of the historical emergence of communication studies in North America. It examines specific problematics and theoretical paradigms as they relate to their contexts of emergence and their underlying logics. It deals with the methodological debates which have occurred between various schools over the competing definitions of communication, and over the broader question of the centrality of communication to society.

Communication 27.521F1 or W1

### **History of Social Communication**

An examination of how major changes in the institutions and technologies of communication have affected the development of western society from the medieval period to the present day. Consideration is given to relevant theoretical studies on communication as well as to selected works on social and cultural history.

Communication 27.523F1 or W1

### **Communication Technology and Society**

The course examines the social and cultural significance of communication and information technology (e.g., computers, television, telecommunication). It examines how these technologies influence and are influenced by major social institutions (e.g., business, government, entertainment) and by cultural practices.

Communication 27.525F1 or W1

### **Communication and Social Relations**

The course provides a detailed analysis of communication processes and practices and the way in which they produce and reproduce the social contexts and relations of gender, age, ethnicity, and political and other socio-cultural attachments. The course explores major theoretical contributions to the understanding of this relationship and considers a number of specific case studies and empirical research findings.

Communication 27.531F1 or W1

### **Communication Institutions, Cultural Industries and State Policy**

The course examines the economic and industrial organization of communication and cultural production in Canada. It introduces students to political economy analysis and institutional analysis of the communication and cultural industries. The course covers the historical development of communication institutions and enterprises, the governing logics and mechanisms of operation, and the role of state agencies in this sector. The course will, among other things, study the notions of market and mandate, labour and leisure, and consumption and choice. The course also considers the state, both as an actor and as a field of intervention in the socio-economic development of communication, and the processes of policy making as they concern contemporary Canadian debates.

Communication 27.555F1 or W1

### **Communication Media**

A research seminar which focuses critically upon one of the communication media (such as radio, television, film, telecommunications, publishing, etc.) with a view to understanding its history, forms and genres, and social uses.

Communication 27.556F1 or W1

### **International Communication**

This course addresses the institutions, processes, and policies in international communication. It does so by discussing the development of global news, mass entertainment, advertising, and telecommunication systems. The course examines public and private international organizations that create media and make international communication policy. It addresses critical issues including the relationship between the freedom to communicate and national sovereignty, the role of international media coverage in world politics, and the impact of global media technologies on traditional cultures.

Communication 27.557F1 or W1

### **History of Canadian Broadcasting**

An examination of the development of public and private radio and television broadcasting in Canada in both English and French from the 1920s to the present day. Consideration will be given to changes in the structure and regulation of the Canadian broadcasting system; the evolution of broadcast technology; developments within areas of programming such as news, public affairs, drama, women's interests, and children's programs; the role of special services such as the CBC Northern Service and Radio Canada International; and controversies such as the debate over Cana-

dian content regulations. Each student will be expected to write a seminar paper based in part on original research using primary source materials such as archival documents, oral history interviews, and extant program tapes.

Communication 27.558F1 or W1

### **Mass, Public, Audience**

This course examines the emergence and evolution of conceptions of modern social organization through the key concepts of mass, public, and audience. It looks at how and why shifts in the understanding of social organization occur, how and why these shifts are theorized, and the implications for communication study.

Communication 27.559F1 or W1

### **Media, Culture and Gender**

This course examines the various theoretical positions which underlie the debates on the production and reproduction of gender relations through communication processes and communication institutions. It addresses current research issues in the feminist debates on culture and communication and explores the possibilities for a feminist politics of communication.

Communication 27.565F1 or W1

### **Special Topics in Communication Research**

The course considers a variety of research protocols and procedures which may include: research organization; documentary research techniques; strategies in textual analysis, including content analysis and thematic analysis; qualitative techniques, including interviewing, observation, and ethnography; quantitative methods, including questionnaires, coding procedures, and statistical analysis; and writing organization and style.

Communication 27.589F1, W1, S1

### **Directed Research**

The student, working under faculty direction, will develop and undertake a research project in order to study a particular subject area.

Communication 27.590F1, W1, S1

### **Directed Studies**

Tutorials or directed readings in selected areas of communication. The student will present papers as the basis for discussion with the tutor.

Communication 27.598F2, W2, S2

### **Research Essay**

Communication 27.599F4, W4, S4

### **M.A. Thesis**

Communication 27.600T2

### **Doctoral Seminar in Communication Studies**

This course begins by examining the disciplinary history of communication. It proceeds to address major schools of thought in the field and leading theoretical and methodological debates, with an emphasis on the three fields of concentration in the program: the history of communication, the political economy of communication, and the socio-cultural analysis of communication.

Communication 27.601F1 or W1

### **Selected Topics in Communication**

A seminar offered from time to time in one of the three fields of concentration.

Communication 27.602F1, W1, S1

### **Tutorial in Communication**

A tutorial in one of the fields of concentration of the program.

Communication 27.603F1, W1, S1

### **Directed Research**

The student, working under faculty direction, will develop and undertake a research project in order to study a particular subject area.

Communication 27.604F1, W1, S1

### **Directed Studies**

Directed readings in selected areas of communication. The student will present papers as the basis for discussion with the tutor.

Communication 27.690F2, W2, S2

### **Ph.D. Tutorial**

A tutorial specifically designed as preparation for the first or breadth comprehensive examination, under the direction of two or more faculty members. The grade to be awarded will be that obtained on both the written examination and the oral defense.

Communication 27.691F2, W2, S2

### **Ph.D. Tutorial**

Working under the direction of three or more faculty members, the selected tutorial provides preparation for the second or depth comprehensive examination. The grade to be awarded is that obtained in the second comprehensive examination.

Communication 27.699F10, W10, S10

### **Ph.D. Thesis**

## **Selection of Courses in Related Disciplines**

In addition to courses offered by the Mass Communication program, the following courses may, with the prior approval of the



supervisor of graduate studies, be used to complete program requirements. This list is not exclusive and is subject to change. Students should be aware that enrolment in these courses may be limited and that registration may be conditional upon obtaining prior approval of the department concerned.

*Note:* It is the responsibility of the student to ensure that permission is obtained from the appropriate department prior to registering in any of the department's courses.

*Canadian Studies*

12.510, 12.520, 12.530

*Economics*

43.533

*Geography*

45.543

*Journalism and Communication*

28.500, 28.550

*Political Economy*

44.500, 44.501

*Political Science*

47.403 Politics and the Media

47.504, 47.541

*Sociology*

53.525, 53.536, 53.538, 53.539, 53.554, 53.555

## Ottawa-Carleton Institute of Mathematics and Statistics

Herzberg Physics 4314  
Telephone: 520-2152  
Fax: 520-3536  
E-mail: mathstat@carleton.ca

### The Institute

**Director of the Institute,** David McDonald

**Associate Director,** Cyril Garner

Students pursuing studies in pure mathematics, applied mathematics, probability and statistics at the graduate level leading to a M.Sc. or a Ph.D. degree do so in a joint program offered by the School of Mathematics and Statistics at Carleton University and the Department of Mathematics and Statistics at the University of Ottawa under the auspices of the Ottawa-Carleton Institute of Mathematics and Statistics. The Institute is responsible for supervising the programs, regulations, and student admissions, as well as providing a framework for interaction between the two departments at the research level.

The list below of all members of the Institute along with their research interests can be used as a guide to possible supervisors.

In addition to the programs administered by the Institute, the School of Mathematics and Statistics at Carleton University offers several other programs.

In cooperation with the Department of Epidemiology and Community Medicine at the University of Ottawa, students may pursue a program leading to an M.Sc. with a Specialization in Biostatistics. For information, see p. 87.

In cooperation with the Department of Systems and Computer Engineering and the School of Computer Science at Carleton University, students may pursue a program leading to an M.Sc. in Information and Systems Science. For information see p. 204.

In cooperation with the School of Computer Science and the Department of Systems and Computer Engineering at Carleton University and the Department of Computer Science at the University of Ottawa, students may pursue a program leading to a Master of Computer Science (M.C.S.). For information see p. 134.

The School of Mathematics and Statistics also offers a cooperative master's program in statistics in collaboration with the federal gov-

ernment, emphasizing practical training through work experience, along with sound training in statistical inference and basic probability theory.

Requests for information and completed applications should be sent to the Director or Associate Director of the Institute.

### Members of the Institute

The home department of each member of the Institute is indicated by (C) for the School of Mathematics and Statistics, Carleton University and (UO) for the Department of Mathematics and Statistics, University of Ottawa

- \* N.U. Ahmed, *Nonlinear Functional Analysis, Control Theory* (UO)
- \* Mayer Alvo, *Nonparametric Statistics, Sequential Analysis* (UO)
- \* Amitava Bose, *Stochastic Modelling, Probability Theory* (C)
- \* W.D. Burgess, *Algebra, Non-Commutative Rings* (UO)
- \* Charles Castonguay, *Demography* (UO)
- \* M.P. Closs, *Native American Mathematics* (UO)
- \* Miklós Csörgő, *Probability and Statistics* (C)
- \* A.R. Dabrowski, *Invariance Principles, Weakly Dependent Variables* (UO)
- \* Daniel Daigle, *Algebraic Geometry, Commutative Algebra* (UO)
- \* D.A. Dawson, *Stochastic Processes and Probability Theory* (C)
- \* Benoit Dionne, *Ordinary Differential Equations, Bifurcation Theory* (UO)
- \* J.D. Dixon, *Group Theory, Algebra Computation* (C)
- \* Vlastimil Dlab, *Finite Dimensional Algebras, Representation Theory* (C)
- \* Che-Kao Fong, *Operator Theory* (C)
- \* Zhicheng Gao, *Graph Theory* (C)
- \* C.W.L. Geyer, *Foundations of Geometry* (C)
- \* Thierry Giordano, *Operator Algebras, Ergodic Theory* (UO)
- \* D.E. Handelman, *K-theory, Operator Algebras, Ring Theory* (UO)
- \* Roger Herz-Fischler, *History and Sociology of Mathematics* (C)
- \* B.G. Ivanoff, *Probability, Point Processes, Martingales* (UO)
- \* Barry Jessup, *Rational Homotopy* (UO)

- \* Daniel Krewski, *Applied Statistics in Medicine* (C)
- \* E.O. Kreyszig, *Partial Differential Equations, Numerical Analysis* (C)
- \* L.E. May, *Numerical Analysis* (C)
- \* D.R. McDonald, *Applied Probability* (UO)
- \* Sam Melkonian, *Non-linear Differential Equations* (C)
- \* S.E. Mills, *Applied Statistics, Statistical Methods, Inference* (C)
- \* A.B. Mingarelli, *Ordinary Differential Equations, Difference Equations* (C)
- \* M. Mojrshiehani, *Resampling, Classification and Pattern Recognition* (C)
- \* B.C. Mortimer, *Group Theory, Coding Theory* (C)
- \* S.A. Naimpally, *Topology* (C)
- \* Erhard Neher, *Jordan Algebras* (UO)
- \* I.D. Nel, *Nonnormable Analysis and Calculus* (C)
- \* J.N. Pandey, *Generalized Functions, Partial Differential Equations* (C)
- \* J.C. Poland, *Group Theory* (C)
- \* I.S. Pressman, *Optimization, Algebra* (C)
- \* Michel Racine, *Jordan Algebras* (UO)
- \* Mizanur Rahman, *Special Functions* (C)
- \* J.N.K. Rao, *Sample Surveys Theory and Methods* (C)
- \* Luis Ribes, *Group Theory* (C)
- \* R.B. Richter, *Graph Theory, Combinatorics* (C)
- \* Ivan Rival, *Combinatorics, Algorithms* (UO)
- \* Wulf Rossmann, *Lie Groups* (UO)
- \* Damien Roy, *Number Theory* (UO)
- \* A.K. Md. E. Saleh, *Order Statistics, Mathematical Statistics* (C)
- \* Iona Schiopu-Kratina, *Probability Theory, Stochastic Processes* (UO)
- \* P.J. Scott, *Logic, Category Theory* (UO)
- \* Barbara Szyszkowicz, *Statistics* (C)
- \* Remi Vaillancourt, *Partial Differential Equations, Numerical Methods* (UO)
- \* K.S. Williams, *Number Theory* (C)

## Master of Science

### Admission Requirements

The normal requirement for admission to the master's program is an Honours bachelor's degree in mathematics, or the equivalent, with at least high honours standing. Applicants holding a general (3 year) degree with at least high honours standing may be admitted to a qualifying-year program.

Their subsequent admission to the regular master's program depends on their performance during the qualifying-year program and will be decided no later than one year after admission to the qualifying-year program. Details are outlined in the general section of this calendar. Students with outstanding academic performance and research promise while in the M.Sc. program may be permitted to transfer to the Ph.D. program without completing the M.Sc. program.

Special consideration may be given, for acceptance in the high-technology concentration, to graduates in computer science or engineering with a strong mathematical background and work experience in the high-technology sector.

### Program Requirements

The two options for the M.Sc. program are:

- \* 2.5 credits and a thesis
- \* 4.0 credits

The courses must be chosen from those at the graduate level except that a student may take up to 1.0 credit of undergraduate courses at the 400-level to satisfy these requirements. Not all these courses may be taken in the same field of mathematics; at least 1.0 credit must be in another field. All master's students are required to participate actively in a seminar or project under the guidance of their adviser. A maximum of 1.0 credit taken outside of the School of Mathematics and Statistics at Carleton University or the Department of Mathematics and Statistics at the University of Ottawa may be allowed for credit.

Students who plan to specialize in probability or statistics are strongly advised that during their master's program they include, where possible, the courses 70.560, 70.551 in mathematical statistics; 70.452, 70.555 in applied statistics, and 70.451, 70.571 in probability, together with 1.0 credit further in the School of Mathematics and Statistics. In addition, a graduate course in another field, such as biology, biostatistics, economics, computer science,



systems analysis, and stochastic modelling, is highly recommended.

## High-Technology Concentration in the M.Sc.

An M.Sc. with a high-technology concentration is available. This concentration is intended for mathematics graduates interested in employment in the high technology area; it is also intended for science or engineering graduates currently employed in the high-technology area who require a greater understanding of mathematics for their work. The course requirement for the high-technology designation on a student's transcript is completion of a minimum of six courses selected from the list of high-technology courses authorized by the Director of the Institute. Each student will be assigned an advisor who will be responsible for approving course selection.

## Doctor of Philosophy

### Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree in mathematics, or the equivalent, with at least high honours standing. Details are outlined in the General Regulations section of this Calendar.

### Program Requirements

The course requirements, which are determined at the time of admission, include a minimum of 3.0 credits and a suitable thesis. Not all of these courses may be taken in the same field of mathematics; at least 1.0 credit must be in another field.

All candidates must take comprehensive examinations, and satisfy a language requirement. The language requirement is determined by the candidate's advisory committee and normally requires the ability to read mathematical literature in a language considered useful for his/her research or career, and other than the candidate's principal language of study.

Students specializing in *mathematics* or *probability* undertake a comprehensive examination in the following areas:

\* The candidate's general area of specialization at the Ph.D. level

\* Examinations on two topics chosen from algebra, analysis, probability, topology, and statistics. (This choice excludes the student's specialty.)

Students specializing in *statistics* must write an examination in the following areas:

\* Mathematical statistics which includes multivariate analysis

\* An examination in probability, and

\* An examination in either (i) applied statistics, or (ii) analysis

In all cases, the examination must be completed successfully within twenty months of initial registration in the Ph.D. program in the case of full-time students, and within thirty-eight months of initial registration in the case of part-time students.

All Ph.D. candidates are also required to undertake a final oral examination on the subject of their thesis.

### Selection of Courses

The following undergraduate courses may, with the approval of the School of Mathematics and Statistics, be selected by master's candidates in partial fulfillment of their degree requirements:

#### *Mathematics and Statistics*

70.401 Vector Calculus

70.415 Rings and Modules

70.417 Commutative Algebra

70.427 Foundations of Geometry

70.428 Introduction to Differentiable Manifolds

70.445 Analytical Dynamics

70.446 Hydrodynamics and Elasticity

70.447 Tensor Analysis and Relativity Theory

70.451 Probability Theory

70.452 Sampling: Theory and Methods

70.453 Applied Multivariate Analysis

70.456 Non-Parametric Methods

70.458 Stochastic Models

70.459 Stochastic Optimization

70.472 Integral Transforms

70.473 Qualitative Theory of Ordinary Differential Equations

70.482 Introduction to Mathematical Logic

70.483 Topics in Applied Logic

70.484 Design and Analysis of Algorithms

70.486 Numerical Analysis

70.488 Graph Theory and Algorithms

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Mathematics 70.501W1 (MAT5120)

### Abstract Measure Theory

Abstract measure and integral, L-spaces, complex measures, product measures, differentiation theory, Fourier transforms.

Prerequisite: Mathematics 70.407★.

Mathematics 70.503F1 (MAT5122)

### Banach Algebras

Commutative Banach algebras; the space of maximal ideals; representation of Banach algebras as function algebras and as operator algebras; the spectrum of an element. Special types of Banach algebras: for example, regular algebras with involution, applications.

Mathematics 70.504F1 (MAT5129)

### Integral Equations

A survey of the main results in the theory of non-singular linear integral equations; Volterra and Fredholm equations of first and second kind in the L<sub>2</sub> case, with special results for the continuous case; Hermitian kernels; eigenfunction expansions; compact operators.

Prerequisites: Mathematics 70.302★ and 70.403★.

Mathematics 70.505F1 (MAT5127)

### Complex Analysis

Complex differentiation and integration, harmonic functions, maximum modulus principle, Runge's theorem, conformal mapping, entire and meromorphic functions, analytic continuation.

Mathematics 70.506F1 (MAT5316)

### Topological Vector Spaces

Construction of new topological vector spaces out of given ones; local convexity and the Hahn-Banach theorem; compactness and the Krein-Milman theorem; conjugate spaces, polar sets.

Prerequisite: Mathematics 70.403★.

Mathematics 70.507F1 (MAT5125)

### Real Analysis I (Measure Theory and Integration)

General measure and integral, Lebesgue measure and integration on  $\mathbb{R}$ , Fubini's theorem, Lebesgue-Radon-Nikodym theorem, absolute

continuity and differentiation, LP-spaces. Selected topics such as Daniell-Stone theory. Also offered at the undergraduate level, with different requirements, as Mathematics 70.407★, for which additional credit is precluded.

Prerequisites: Mathematics 70.301★ and 70.302★ (MAT3125) or permission of the Department.

Mathematics 70.508W1 (MAT5126)

### Real Analysis II (Functional Analysis)

Banach and Hilbert spaces, bounded linear operators, dual spaces. Topics selected from: weak-topologies, Alaoglu's theorem, compact operators, differential calculus in Banach spaces, Riesz representation theorems. Also offered at the undergraduate level, with different requirements, as Mathematics 70.403★, for which additional credit is precluded.

Prerequisite: Mathematics 70.507 (MAT5125) or permission of the Department.

Mathematics 70.509F1 (MAT5121)

### Introduction to Hilbert Space

Geometry of Hilbert Space, spectral theory of linear operators in Hilbert Space.

Prerequisites: Mathematics 70.301★, 70.302★, and 70.403★.

Mathematics 70.512F1 (MAT5148)

### Group Representations and Applications

An introduction to group representations and character theory, with selected applications.

Mathematics 70.513F1 (MAT5146)

### Rings and Modules

Generalizations of the Wedderburn-Artin theorem and applications, homological algebra.

Mathematics 70.514F1 (MAT5143)

### Lie Algebras

Basic concepts; ideals, homomorphisms, nilpotent, solvable, semi-simple.

Representations, universal enveloping algebra. Semi-simple Lie algebras: structure theory, classification, representation theory.

Prerequisites: Mathematics 70.517 (MAT5141) and 70.519 (MAT5142) or permission of the Department.

Mathematics 70.516W1 (MAT5145)

### Group Theory

Fundamental principles as applied to abelian, nilpotent, solvable, free, and finite groups; representations. Also offered at the undergraduate level, with different requirements, as Mathematics 70.416★, for which additional credit is precluded.

Prerequisite: Mathematics 70.310 or permission of the Department.

Mathematics 70.517F1 (MAT5141)

### Algebra I

Groups, Sylow subgroups, finitely generated

abelian groups. Rings, field of fractions, principal ideal domains, modules. Polynomial algebra, Euclidean algorithm, unique factorization.

Prerequisite: Permission of the Department.

Mathematics 70.518W1 (MAT5147)

### **Homological Algebra and Category Theory**

Axioms of set theory, categories, functors, natural transformations; free, projective, injective and flat modules; tensor products and homology functors, derived functors; dimension theory. Also offered at the undergraduate level, with different requirements, as Mathematics 70.418, for which additional credit is precluded.

Prerequisite: Mathematics 70.310 or permission of the Department.

Mathematics 70.519W1 (MAT5142)

### **Algebra II**

Field theory, algebraic and transcendental extensions, finite fields, Galois groups. Modules over principal ideal domains, decomposition of a linear transformation, Jordan normal form.

Prerequisites: Mathematics 70.517 (MAT5141) and permission of the Department.

Mathematics 70.521W1 (MAT5150)

### **Topics in Geometry**

Various axiom systems of geometry. Detailed examinations of at least one modern approach to foundations, with emphasis upon the connections with group theory.

Prerequisite: Permission of the Department.

Mathematics 70.522F1 (MAT5168)

### **Homology Theory**

The Eilenberg-Steenrod axioms and their consequences, singular homology theory, applications to topology and algebra.

Prerequisite: Mathematics 70.425★.

Mathematics 70.525F1 (MAT5151)

### **Topology I**

Topological spaces, product and identification topologies, countability and separation axioms, compactness, connectedness, homotopy, fundamental group, net and filter convergence. Also offered at the undergraduate level, with different requirements, as Mathematics 70.425★, for which additional credit is precluded.

Prerequisite: Mathematics 70.301★ or permission of the Department.

Mathematics 70.526W1 (MAT5152)

### **Topology II**

Covering spaces, homology via the Eilenberg-Steenrod Axioms, applications, construction of a homology functor. Also offered at the undergraduate level, with different requirements, as Mathematics 70.426★, for which ad-

ditional credit is precluded.

Prerequisites: Mathematics 70.310 (MAT3143) and 70.525 (MAT5151) or permission of the Department.

Mathematics 70.527F1 (MAT5169)

### **Foundations of Geometry**

A study of at least one modern axiom system of Euclidean and non-Euclidean geometry, embedding of hyperbolic and Euclidean geometries in the projective plane, groups of motions, models of non-Euclidean geometry. Prerequisite: Mathematics 70.310 (may be taken concurrently) or permission of the Department.

Mathematics 70.528F1 (MAT5155)

### **Differentiable Manifolds**

A study of differentiable manifolds from the point of view of either differential topology or differential geometry. Topics such as smooth mappings, transversality, intersection theory, vector fields on manifolds, Gaussian curvature, Riemannian manifolds, differential forms, tensors, and connections are included. Prerequisite: Mathematics 70.301★ or permission of the Department.

Mathematics 70.531F1 (MAT5161)

### **Mathematical Logic**

A basic graduate course in mathematical logic. Propositional and predicate logic, proof theory, Gentzen's Cut-Elimination, completeness, compactness, Henkin models, model theory, arithmetic and undecidability. Special topics time permitting) depending on interests of instructor and audience.

Prerequisites: Honours undergraduate algebra, analysis and topology or permission of the instructor.

Mathematics 70.535F1 (MAT5163)

### **Analytic Number Theory**

Dirichlet series, characters, Zeta-functions, prime number theorem, Dirichlet's theorem on primes in arithmetic progressions, binary quadratic forms. Also offered at the undergraduate level, with different requirements, as Mathematics 70.435★, for which additional credit is precluded.

Prerequisite: Mathematics 70.307★ or permission of the Department.

Mathematics 70.536W1 (MAT5164)

### **Algebraic Number Theory**

Algebraic number fields, bases, algebraic integers, integral bases, arithmetic in algebraic number fields, ideal theory, class number. Also offered at the undergraduate level, with different requirements, as Mathematics 70.436★, for which additional credit is precluded.



Prerequisite: Mathematics 70.310 or permission of the Department.

Mathematics 70.543 (MAT5187)

### **Topics in Applied Mathematics**

Mathematics 70.545F1 (MAT5131)

### **Ordinary Differential Equations**

Existence and uniqueness theorems, boundary value problems, qualitative theory.

Prerequisite: Mathematics 70.308★ or permission of the Department.

Mathematics 70.546F1 (MAT5133)

### **Introduction to Partial Differential Equations**

First order linear, quasi-linear, and nonlinear equations; second order equations in two or more variables; systems of equations; the wave equation; Laplace and Poisson equations; Dirichlet and Neumann problems; Green's functions. Also offered at the undergraduate level, with different requirements, as Mathematics 70.470★, for which additional credit is precluded.

Prerequisite: Mathematics 70.302★, or 70.307★ and 70.308★, or permission of the Department.

Mathematics 70.547W1 (MAT5134)

### **Topics in Partial Differential Equations**

Theory of distributions, initial-value problems based on two-dimensional wave equations, Laplace transform, Fourier integral transform, diffusion problems, Helmholtz equation with application to boundary and initial-value problems in cylindrical and spherical coordinates. Also offered at the undergraduate level, with different requirements, as Mathematics 70.471★, for which additional credit is precluded.

Prerequisite: Mathematics 70.546 or permission of the Department.

Mathematics 70.550F1 (MAT5177)

### **Multivariate Normal Theory**

Multivariate normal distribution properties, characterization, estimation of means, and covariance matrix. Regression approach to distribution theory of statistics; multivariate tests; correlations; classification of observations; Wilks' criteria.

Prerequisite: Mathematics 70.350.

Mathematics 70.551W1 (MAT5191)

### **Mathematical Statistics II**

Confidence intervals and pivots; Bayesian intervals; optimal tests and Neyman-Pearson theory; likelihood ratio and score tests; significance tests; goodness-of-fit-tests; large sample theory and applications to maximum likelihood and robust estimation. Also offered at the undergraduate level, with different requirements, as Mathematics 70.457★, for which ad-

ditional credit is precluded.

Prerequisite: Mathematics 70.450★ or 70.560 or permission of the Department.

Mathematics 70.552W1 (MAT5192)

### **Sampling Theory and Methods**

Unequal probability sampling with and without replacement; unified theory for standard errors; prediction approach; ratio and regression estimation; stratification and optimal designs; multistage cluster sampling; double sampling; domains of study; post-stratification; nonresponse; measurement errors; related topics.

Prerequisite: Mathematics 70.452★ or permission of the Department.

Mathematics 70.553F1 (MAT5193)

### **Linear Models**

Theory of non full rank linear models; estimable functions, best linear unbiased estimators, hypotheses testing, confidence regions; multi-way classifications; analysis of covariance; variance component models; maximum likelihood estimation, Minque, Anova methods; miscellaneous topics.

Prerequisite: Mathematics 70.450★ or 70.560 or permission of the Department.

Mathematics 70.554F1 (MAT5194)

### **Stochastic Processes and Time Series Analysis**

Stationary stochastic processes, inference for stochastic processes, applications to time series and spatial series analysis.

Prerequisite: Mathematics 70.451★ or permission of the Department.

Mathematics 70.555W1 (MAT5195)

### **Design of Experiments**

Overview of linear model theory; orthogonality; randomized block and split plot designs; latin square designs; randomization theory; incomplete block designs; factorial experiments: confounding and fractional replication; response surface methodology. Miscellaneous topics.

Prerequisite: Mathematics 70.355★ or 70.450★ or 70.560 or permission of the Department.

Mathematics 70.556W1 (MAT5175)

### **Robust Statistical Inference**

Nonparametric tests for location, scale, and regression parameters; derivation of rank tests; distribution theory of linear rank statistics and their efficiency. Robust estimation of location, scale and regression parameters; Huber's M-estimators, Rank-methods, L-estimators. Influence function. Adaptive procedures.

Also offered at the undergraduate level, with different requirements, as Mathematics

70.456★, for which additional credit is precluded.

Prerequisite: Mathematics 70.450★ or 70.560 or permission of the Department.

Mathematics 70.557W1 (MAT5176)

#### **Advanced Statistical Inference**

Pure significance test; uniformly most powerful unbiased and invariant tests; asymptotic comparison of tests; confidence intervals; large-sample theory of likelihood ratio and chi-square tests; likelihood inference; Bayesian inference and topics such as empirical Bayes inference; fiducial and structural methods; resampling methods.

Prerequisite: Mathematics 70.457★ or 70.551 or permission of the Department.

Mathematics 70.558F1 (MAT5172)

#### **Topics in Stochastic Processes**

Course contents will vary, but will include topics drawn from Markov processes. Brownian motion, stochastic differential equations, martingales, Markov random fields, random measures, and infinite particle systems, advanced topics in modelling, population models, etc.

Prerequisites: Mathematics 70.356★ or 70.451★, or permission of the Department.

Mathematics 70.559F1 (MAT5196)

#### **Multivariate Analysis**

Multivariate methods of data analysis, including principal components, cluster analysis, factor analysis, canonical correlation, MANOVA, profile analysis, discriminant analysis, path analysis. Also offered at the undergraduate level, with different requirements, as Mathematics 70.453★, for which additional credit is precluded.

Prerequisite: Mathematics 70.450★ or 70.560 or permission of the Department.

Mathematics 70.560F1 (MAT5190)

#### **Mathematical Statistics I**

Statistical decision theory; likelihood functions; sufficiency; factorization theorem; exponential families; UMVU estimators; Fisher's information; Cramer-Rao lower bound; maximum likelihood and moment estimation; invariant and robust point estimation; asymptotic properties; Bayesian point estimation. Also offered at the undergraduate level, with different requirements, as Mathematics 70.450★, for which additional credit is precluded.

Prerequisite: Mathematics 70.350 or permission of the Department.

Mathematics 70.561F1 (MAT5197)

#### **Stochastic Optimization**

Topics chosen from stochastic dynamic programming, Markov decision processes, search theory, optimal stopping. Also offered at the undergraduate level, with different require-

ments, as Mathematics 70.459★, for which additional credit is precluded.

Prerequisite: Mathematics 70.356★ or permission of the Department.

Mathematics 70.562F1 (MAT5317)

#### **Analysis of Categorical Data**

Analysis of one-way and two-way tables of nominal data; multi-dimensional contingency tables and log-linear models; tests of symmetry and marginal homogeneity in square tables; incomplete tables; tables with ordered categories; fixed margins and logistic models with binary response; measures of association and agreement; applications in biological, social and medical sciences.

Prerequisites: Mathematics 70.450★ or 70.560, 70.457★ or 70.551, or permission of the Department.

Mathematics 70.563W1 (MAT5318)

#### **Reliability and Survival Analysis**

Types of censored data; nonparametric estimation of survival function; graphical procedures for model identification; parametric models and maximum likelihood estimation; exponential and Weibull regression models; nonparametric hazard function models and associated statistical inference; rank tests with censored data; engineering, medical and biological sciences applications.

Prerequisites: Mathematics 70.450★ or 70.560, 70.457★ or 70.551 or permission of the Department.

Mathematics 70.564F1 (MAT5173)

#### **Stochastic Analysis**

Brownian motion, continuous martingales, and stochastic integration.

Prerequisites: Mathematics 70.451★ or 70.578 or permission of the Department.

Mathematics 70.565F1 (MAT5165)

#### **Theory of Automata**

Algebraic structure of sequential machines, de-composition of machines; finite automata, formal languages; complexity. Also offered at the undergraduate level, with different requirements, as Mathematics 70.485★/Computer Science 95.485★, for which additional credit is precluded.

Prerequisite: Mathematics 70.210 or permission of the Department.

Mathematics 70.567F1 (MAT5324)

#### **Game Theory**

Two-person zero-sum games; infinite games; multi-stage games; differential games; utility theory; two-person general-sum games; bargaining problem; n-person games; games with a continuum of players. Also offered at the undergraduate level, with different require-

ments, as Mathematics 70.487★, for which additional credit is precluded.

Prerequisite: Mathematics 70.301★ or permission of the Department.

Mathematics 70.569F1 (MAT5301)

### **Topics in Combinatorial Mathematics**

Prerequisite: Permission of the Department.

Mathematics 70.571W1 (MAT5198)

### **Stochastic Models**

Markov systems, stochastic networks, queuing networks, spatial processes, approximation methods in stochastic processes and queuing theory. Applications to the modeling and analysis of computer-communications systems and other distributed networks. Also offered at the undergraduate level, with different requirements, as Mathematics 70.458★, for which additional credit is precluded.

Prerequisite: Mathematics 70.356★ or permission of the Department.

Mathematics 70.578F1 (MAT5170)

### **Probability Theory I**

Probability spaces, random variables, expected values as integrals, joint distributions, independence and product measures, cumulative distribution functions and extensions of probability measures, Borel-Cantelli lemmas, convergence concepts, independent identically distributed sequences of random variables.

Prerequisites: Mathematics 70.301★, 70.302★, and 70.350, or permission of the Department.

Mathematics 70.579W1 (MAT5171)

### **Probability Theory II**

Laws of large numbers, characteristic functions, central limit theorem, conditional probabilities and expectations, basic properties and convergence theorems for martingales, introduction to Brownian motion.

Prerequisite: Mathematics 70.578 (MAT5170) or permission of the Department.

Mathematics 70.581F1 (MAT5303)

### **Linear Optimization**

Linear programming problems; simplex method, upper bounded variables, free variables; duality; postoptimality analysis; linear programs having special structures; integer programming problems; unimodularity; knapsack problem.

Prerequisite: Course in linear algebra and permission of the Department.

Mathematics 70.582F1 (MAT5325)

### **Introduction to Information and Systems Science**

An introduction to the process of applying computers in problem-solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are

presented: data manipulation, databases, computer networks, queuing systems, optimization. (Also listed as Engineering 94.582, Computer Science 95.582 and Information and Systems Science 93.582)

Mathematics 70.583W1 (MAT5304)

### **Nonlinear Optimization**

Methods for unconstrained and constrained optimization problems; Kuhn-Tucker conditions; penalty functions; duality; quadratic programming; geometric programming; separable programming; integer nonlinear programming; pseudo-Boolean programming; dynamic programming.

Prerequisite: Permission of the Department.

Mathematics 70.584F1, W1, S1 (MAT5307)

### **Topics in Operations Research**

Mathematics 70.585F1, W1, S1 (MAT5308)

### **Topics in Algorithm Design**

Mathematics 70.586F1 (MAT5180)

### **Numerical Analysis**

Error analysis for fixed and floating point arithmetic; systems of linear equations; eigen-value problems; sparse matrices; interpolation and approximation, including Fourier approximation; numerical solution of ordinary and partial differential equations.

Prerequisite: Permission of the Department.

Mathematics 70/95.587F1 (MAT5167)

### **Formal Language and Syntax Analysis**

Computability, unsolvable and NP-hard problems. Formal languages, classes of language automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient parsers, LR, LR(O), LR(k), SLR, LL(k). Syntax directed translation. Prerequisites: Mathematics 70.565 or 70.485★ or Computer Science 95.302a, or permission of the Department.

Mathematics 70.588W1 (MAT5305)

### **Combinatorial Optimization I**

Network flow theory and related material. Topics will include shortest paths, minimum spanning trees, maximum flows, minimum cost flows. Optimal matching in bipartite graphs.

Prerequisite: Permission of the Department.

Mathematics 70.589W1 (MAT5306)

### **Combinatorial Optimization II**

Topics include optimal matching in non-bipartite graphs, Euler tours and the Chinese Postman problem. Other extensions of network flows: dynamic flows, multicommodity flows, and flows with gains, Bottleneck problems. Matroid optimization. Enumerative and



heuristic algorithms for the Travelling Salesman and other "hard" problems.  
Prerequisite: Mathematics 70.588.

Mathematics 70.590F1, W1, S1 (MAT5990)  
**Seminar**

Mathematics 70.591F1, W1, S1 (MAT5991)  
**Directed Studies**

Mathematics 70.593F1, W1, S1

**Project**

This course is intended for students registered in the M.Sc. degree program in Information and Systems Science and the M.C.S. program. Students pursuing the non-thesis option will conduct a study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a typewritten report and presented at a departmental seminar.

Mathematics 70.594F1, W1, S1

**Statistical Internship**

This course is project-oriented and affords students the opportunity to undertake statistical research and data analysis projects either within the Statistical Consulting Centre or as a cooperative project with governmental or industrial sponsors. In addition to project work, seminars on related topics will be conducted. Practical data analysis and consulting skills will be emphasized. The grade assigned in this course will be based upon oral and written presentation of analysis results and will be determined in consultation with the faculty adviser and the sponsor. Permission of the Institute is required for registration in this course.

Mathematics 70/94/95.595F4, W4, S4  
**M.C.S. Thesis**

Mathematics 70/93/94/95.598 F3, W3, S3  
**M.Sc. Thesis in Information and Systems Science**

Mathematics 70.599F3, W3, S3  
**M.Sc. Thesis**

Mathematics 70.602W1 (MAT5309)

**Harmonic Analysis on Groups**

Transformation groups; Haar measure; unitary representations of locally compact groups; completeness and compact groups; character theory; decomposition.

Mathematics 70.608F1, W1, S1 (MAT5326)  
**Topics in Analysis**

Mathematics 70.609F1, W1, S1 (MAT5329)  
**Topics in Analysis**

Mathematics 70.611F1, W1, S1 (MAT5327)

**Topics in Algebra**

Mathematics 70.612F1, W1, S1 (MAT5330)

**Topics in Algebra**

Mathematics 70.613F1, W1, S1 (MAT5331)

**Topics in Algebra**

Mathematics 70.614W1 (MAT5158)

**Lie Groups**

Matrix groups: one-parameter groups, exponential map, Campbell-Hausdorff formula, Lie algebra of a matrix group, integration on matrix groups. Abstract Lie groups.

Prerequisites: Mathematics 70.507 and 50.517 or permission of the Department.

Mathematics 70.621F1, W1, S1 (MAT5312)

**Topics in Topology**

Mathematics 70.657F1, W1, S1 (MAT5313)

**Topics in Probability and Statistics**

Mathematics 70.658F1, W1, S1 (MAT5314)

**Topics in Probability and Statistics**

Mathematics 70.686F1, W1, S1 (MAT5361)

**Topics in Mathematical Logic**

Mathematics 70.687F1 (MAT5162)

**Mathematical Foundations of Computer Science**

Foundations of functional languages, lambda calculi (typed, polymorphically typed, untyped), Curry-Howard Isomorphism, proofs-as-programs, normalization and rewriting theory, operational semantics, type assignment, introduction to denotational semantics of programs, fixed-point programming. Topics chosen from: denotational semantics for lambda calculi, models of programming languages, complexity theory and logic of computation, models of concurrent and distributed systems, etc.

Prerequisites: Honours undergraduate algebra and either topology or analysis, permission of the instructor or some acquaintance with logic.

Mathematics 70.690F1, W1, S1 (MAT6990)  
**Seminar**

Mathematics 70.691F1, W1, S1 (MAT6991)

**Directed Studies**

Mathematics 70.699F, W, S  
**Ph.D. Thesis**

# The Ottawa-Carleton Institute for Mechanical and Aerospace Engineering

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University of Ottawa



Carleton University

## The Institute

**Director of the Institute, D. Redekop**

Established in 1984, the Institute combines the research strengths and resources of the Departments of Mechanical and Aerospace Engineering at Carleton University and Mechanical Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the Institute in a range of fields of mechanical and aerospace and materials engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research. Requests for information and applications for admission may be sent to the Director of the Institute.

## Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Mechanical and Aerospace Engineering, Carleton University, and by (O) for the Department of Mechanical Engineering, University of Ottawa.

- \* FF. Afagh, *Structural Dynamics and Control, Solid Mechanics, Smart Structures*(C)
- \* Melek Akben, *Metallurgy, Welding, Hot Working of Metals*(O)
- \* Andrei Artemev, *Phase Transformations, Solidification Processes*(C)
- \* J.C. Beddoes, *Physical Metallurgy and Metal Processing*(C)
- \* Robert Bell, *Finite Element Analysis, Stress Analysis, Solid Mechanics, Fracture Mechanics*(C)
- \* M.J. Bibby, *Materials and Manufacturing Engineering, Weld Analysis*(C)
- \* Shui-Chih Cheng, *Heat Transfer, Numerical Methods*(O)
- \* M.C. de Malherbe, *Design, Manufacturing Engineering Processes*(C-Adjunct)
- \* Balbir Dhillon, *Reliability*(O)

- \* Atef Fahim, *CAD/CAM, Controls*(O)
- \* P.R. Frise, *Fracture Mechanics, Fatigue, Non-destructive Testing*(C-Adjunct)
- \* J.A. Gaydos, *Thermodynamics, Continuum Mechanics*(C)
- \* K.R. Goheen, *Controls, CAD/CAM/CIM*(C-Adjunct)
- \* J.A. Goldak, *Computer-Integrated Manufacturing Processes, Finite Element Modelling of Manufacturing*(C)
- \* D.J. Gorman, Professor Emeritus, *Vibrations*, (O)
- \* D.C. Groeneveld, *Heat Transfer, Two Phase Flow*(O-Adjunct)
- \* Yehai Haddad, *Applied Mechanics, Materials and Design*(O)
- \* W.L. Hallett, *Fluid Mechanics, Combustion*(O)
- \* E.S. Hanff, *Unsteady Aerodynamics, Unsteady Wind Tunnel Techniques*(C-Adjunct)
- \* C.H. Herson, *Spacecraft Design Instrumentation*(C-Adjunct)
- \* Alex Jablonski, *Space Dynamics, Vibrations, Continuum Mechanics*(C-Adjunct)
- \* B. Jodoin, *Thermofluids, Plasma Physics*(O)
- \* R.J. Kind, *Aerodynamics of Aircraft and Turbomachinery*(C)
- \* A.K. Koul, *Superalloys, Creep, Fatigue, Fracture Mechanics, Modelling*(C-Adjunct)
- \* A.S. Krausz, Professor Emeritus, *Fracture, Plasticity, Manufacturing*, (O)
- \* B.H.K. Lee, *Aerodynamics, Aeroelasticity*(O-Adjunct)
- \* Yung Lee, Professor Emeritus, *Heat Transfer, Nuclear Engineering*(O)
- \* Ming Liang, *Production and Manufacturing Systems*(O)
- \* C. Mallory, *Materials, Welding*(O)
- \* J.M. McDill, *Adaptive Thermal-microstructural Mechanical Finite Element Analysis for Manufacturing Processes*(C)
- \* N.B. McLaughlin, *Tractive Performance of Four-Wheel Drive Tractors*(C-Adjunct)
- \* J.J. McPhee, *Virtual Prototyping*(C-Adjunct)
- \* R.E. Milane, *Combustion, Fluid Mechanics*(O)
- \* Shaikat Mirza, Professor Emeritus, *Vibrations, Stress Analysis*(O)

- \* Hany Moustapha, *Turbomachinery, Aerodynamics* (C-Adjunct)
- \* M.B. Munro, *Composite Materials* (O)
- \* Tofy Mussivand, *Medical Devices Design, Evaluation (in vitro, in vivo, clinical), Artificial Heart Sensors, Valves and Prosthetics* (C-Adjunct)
- \* D.S. Neculescu, *Control, Robotics, Reliability* (O)
- \* F.Nitzsche, *Aeroelasticity, Control* (C-Adjunct)
- \* A.K. Pilkey, *Physical Metallurgy, Failure Mechanisms, Quantitative Metallography* (C)
- \* E.G. Plett, *Energy Systems, Fluid Mechanics, Thermodynamics and Heat Transfer, Numerical Modelling* (C)
- \* David Redekop, *Applied Mechanics, Finite Element Analysis, Robotics* (O)
- \* W.G. Richarz, *Aeronautical Engineering, Acoustics, Instrumentation* (C-Adjunct)
- \* J.T. Rogers, Professor Emeritus, *Heat Transfer, Energy Systems, Nuclear Engineering* (C-Adjunct)
- \* D.L. Russell, *Dynamics, Controls, Medical Device Design* (C)
- \* H.T. Saliba, *Vibrations* (O-Adjunct)
- \* H.I.H. Saravanamuttoo, Professor Emeritus, *Gas Turbine Performance, Engine Health Monitoring* (C)
- \* J.Z. Sasiadek, *Robotics and Automation, Guidance, Navigation and Computer Control Systems* (C)
- \* H.M. Schwartz, *Automation, Robotics, Controls* (C)
- \* J.S. Sinkiewicz, *Robotics, Guidance, Navigation, Space* (C-Adjunct)
- \* S.A. Sjolander, *Aerodynamics, Turbomachinery, Wind-Tunnel Engineering* (C)
- \* D.A. Staley, *Spacecraft Dynamics and Control* (C)
- \* P.V. Straznicki, *Design, Light Weight Structures* (C)
- \* C.L. Tan, *Solid Mechanics, Fracture Mechanics, Boundary Integral and Finite Element Methods* (C)
- \* Stavros Tavoularis, *Fluid Mechanics, Experimental Techniques* (O)
- \* Frank Vigneron, *Space Dynamics* (C-Adjunct)
- \* George Vukovich, *Control Systems* (C-Adjunct)

- \* W. Wallace, *Materials Engineering* (C-Adjunct)
- \* J.Y. Wong, *Véhicule Engineering, Transportation Technology* (C)
- \* M.J. Worswick, *Solid Mechanics, High Strain Rate, Metal Forming* (C)
- \* M.I. Yaras, *Turbomachinery, Aerodynamics, Computational Fluid Dynamics* (C)
- \* J.S. Zhang, *Material Emission Characteristics, Indoor Air Quality Modelling* (C-Adjunct)

## Master's Degree

### Admission Requirements

The normal requirement for admission to the master's program is a bachelor's degree with at least high honours standing in mechanical or aerospace engineering or a related discipline.

### Program Requirements

The requirements for course work are specified in terms of credits: one credit is one hour/week for one term (thirteen weeks). The requirements for the master's degree by thesis are:

- \* Eighteen course credits
- \* Participation in the Mechanical and Aerospace Engineering seminar series
- \* Thesis

The requirements for the master's degree by course work are: twenty-seven course credits plus a project equivalent to nine course credits (Engineering 88.598 for Carleton University students; MCG6000 for University of Ottawa students).

### Guidelines for Completion of Master's Degree

Students are expected to complete the master's program within the maximum limits outlined in the Section 13.2 of the General Regulations section of this Calendar (see p. 63.)

### Doctor of Philosophy

### Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree in mechanical or aerospace engineering or a related discipline. Students who have been admitted to the master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.



## Program Requirements

The requirements for the Ph.D. degree (from the master's degree) are:

\* Nine course credits

\* Participation in the Mechanical and Aerospace Engineering seminar series

\* Successful completion of qualifying examinations

\* Thesis. The examining board for all theses will include professors from both departments and an external examiner who is a member of neither university.

Students who have been permitted to transfer into the Ph.D. program from a master's program require twenty-seven course credits for the Ph.D.

## Guidelines for Completion of Doctoral Degree

Students are expected to complete the doctoral program within the maximum time limits outlined in section 13.3 of the General Regulations section of this Calendar. In addition, Ph.D. candidates are required to complete Parts I, II, and III of the Ph.D. comprehensive examinations according to the timing outlined in the Ph.D. comprehensive guidelines which are distributed by the department involved.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

In all programs, the student may choose graduate courses from either university with the approval of the adviser or the advisory committee. The available graduate courses are listed below, grouped by subject area. Course descriptions are to be found in the departmental section of the calendar concerned. All courses are of one term duration. The following codes identify the department offering the course: "88" Department of Mechanical and Aerospace Engineering, Carleton University, "89" Department of Mechanical Engineering, University of Ottawa

### Thermofluids

88.500 (MCG5300) 88.501 (MCG5301)  
88.503 (MCG5303) 88.504 (MCG5304)  
88.508 (MCG5308) 88.509 (MCG5309)  
88.521 (MCG5321) 88.530 (MCG5330)

88.531 (MCG5331) 88.532 (MCG5332)  
88.534 (MCG5334) 88.543 (MCG5343)  
88.547 (MCG5347) 88.548 (MCG5348)  
88.586 (MCG5386) 89.511 (MCG5111)  
89.531 (MCG5131) 89.532 (MCG5132)  
89.533 (MCG5133) 89.534 (MCG5134)  
89.536 (MCG5136) 89.541 (MCG5141)  
89.548 (MCG5551) 89.549 (MCG5552)  
89.550 (MCG5557) 89.551 (MCG5151)  
89.552 (MCG5152) 89.555 (MCG5155)  
89.556 (MCG5156) 89.557 (MCG5157)  
89.558 (MCG5158) 89.561 (MCG5161)  
89.591 (MCG5191) 89.592 (MCG5192)

### Solid Mechanics and Materials

88.517 (MCG5317) 88.550 (MCG5350)  
88.555 (MCG5355) 88.561 (MCG5361)  
88.562 (MCG5362) 88.563 (MCG5381)  
88.565 (MCG5365) 88.566 (MCG5366)  
88.567 (MCG5367) 88.568 (MCG5368)  
88.580 (MCG5480I) 88.582 (MCG5483I)  
88.583 (MCG5488I) 88.585 (MCG5482I)  
89.501 (MCG5101) 89.502 (MCG5102)  
89.503 (MCG5103) 89.504 (MCG5104)  
89.505 (MCG5105) 89.506 (MCG5106)  
89.507 (MCG5107) 89.508 (MCG5108)  
89.509 (MCG5109) 89.510 (MCG5110)  
89.514 (MCG5114) 89.515 (MCG5115)  
89.517 (MCG5117) 89.518 (MCG5118)  
89.519 (MCG5119) 89.526 (MCG5126)  
89.529 (MCG5129) 89.537 (MCG5137)  
89.580 (MCG5180) 89.581 (MCG5181)  
89.582 (MCG5182) 89.586 (MCG5186)

### Design and Manufacturing

88.552 (MCG5352) 88.553 (MCG5353)  
88.561 (MCG5361) 88.562 (MCG5362)  
88.564 (MCG5364) 88.574 (MCG5374)  
88.575 (MCG5375) 88.581 (MCG5489I)  
89.515 (MCG5115) 89.559 (MCG5159)  
89.568 (MCG5168) 89.569 (MCG5169)  
89.570 (MCG5170) 89.571 (MCG5171)  
89.572 (MCG5172) 89.573 (MCG5173)  
89.576 (MCG5176) 89.577 (MCG5177)  
89.578 (MCG5178) 89.579 (MCG5179)  
89.585 (MCG5185)

### Transportation Technology

88.510 (MCG5310) 88.511 (MCG5311)  
88.514 (MCG5314) 88.515 (MCG5315)  
88.521 (MCG5321) 88.530 (MCG5330)  
88.531 (MCG5331) 88.541 (MCG5341)  
88.542 (MCG5342) 88.554 (MCG5354)  
88.556 (MCG5356) 89.538 (MCG5138)  
88.596 (MCG5395) 88.598 (MCG5398)  
89.500 (MCG6000)

In addition, graduate courses offered by departments in other disciplines may be taken for credit with approval by the department in which the student is registered.

## Mechanical and Aerospace Engineering

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Fax: 520-5715  
E-mail: kristin\_cooper@carleton.ca  
WWW address: <http://www.mae.carleton.ca>

### The Department

Chair of the Department, Robert Bell

Associate Chair (Graduate Studies), F.F. Afagh

In addition to University and Graduate Faculty regulations, all Engineering departments share common procedures that are described in Section 18 of the General Regulations (see p. 66).

The Department of Mechanical and Aerospace Engineering offers programs of study and research leading to M.Eng. degrees in Aerospace Engineering, Materials Engineering, and Mechanical Engineering, and to Ph.D. degrees in Aerospace and Mechanical Engineering. These degrees are offered through the Ottawa-Carleton Institute for Mechanical and Aerospace Engineering, which is jointly administered by the Department of Mechanical and Aerospace Engineering at Carleton University, and the Department of Mechanical Engineering at the University of Ottawa. For further information, including admission and program requirements, see p. 236.

Programs of research and study are offered in several areas:

- \* Aerodynamics and Gas Dynamics
- \* Heat Transfer
- \* Stress and Failure Analysis
- \* Lightweight Structures and Aeroelasticity
- \* Vibration Analysis
- \* Computer-Aided Design and Engineering
- \* Robotics
- \* Control Systems
- \* Vehicle (Performance and Safety)
- \* Engineering
- \* Nuclear Engineering
- \* Energy Systems
- \* Energy Conversion and Utilization
- \* Manufacturing Engineering
- \* Materials Engineering

The Department has a major research commitment, both analytical and experimental, to thermofluid-dynamic and mechanical problems of gas turbine engine design and operation. Current work includes flow prediction and analysis in turbo-machines; two- and three-dimensional boundary layer behaviour; tip-leakage effects and other losses; dynamics of gas turbine power plants; design and performance of highly loaded turbines; engine noise; stress, deformation, and vibration of compressor and turbine blades and discs; finite element analysis; dynamics of high-speed rotors and failure modes of materials in extreme environments.

Another area of intense research effort in the Department is computer-aided engineering. Activities in this field include computer-aided analysis (including computational fluid dynamics as well as the finite and boundary element methods), computer-aided design, and computer-integrated manufacturing. Projects include thermal and mechanical analysis of welding and casting processes, heat and fluid flow analyses, stress, deformation (manufacturing processes), vibration and fracture mechanics studies, and solids modelling. Computer-aided engineering is well supported by computer hardware and software, including a state-of-the-art network of engineering workstations. The Department has a substantial involvement in the Manufacturing Research Centre of Ontario.

As part of the faculty interest in transportation, the Department is active in research on air and ground vehicle technology. Current studies include computational methods for steady and unsteady flows over complex configurations; effects of roughness on aerodynamic performance; aircraft noise; boundary layer separation and control; propeller and rotor aerodynamics and noise. The Transport Technology Research Laboratory has been organized for ground transport studies; design and optimization of off-road vehicles; vehicle safety; anti-lock braking systems; vehicle-terrain interaction; effect of vibration on vehicle performance; dynamics of air-cushion and magnetically levitated vehicles and composite and structural elements.

Members of the Department are engaged in research on various aspects of energy conversion, storage, and utilization. In addition to the previously mentioned work on gas turbines, research is being undertaken on nuclear energy, effectiveness of energy end-use, and behaviour in wind of energy-conserving cladding systems for buildings. In the nuclear energy field, research is being undertaken in heat transfer and fluid flow aspects of CANDU

and SLOWPOKE reactors, with a major effort on thermohydraulic problems in reactor safety. Work is also in progress on reactor safety in general, with a special emphasis on risk. Research activities in this field also include studies on the utilization of CANDU reactors for thermal energy supply as well as electrical generation, and on applications of up-rated SLOWPOKE reactors to low-temperature industrial heating and to building energy needs. Research is being carried out into the structural integrity of CANDU reactor components in the form of evaluations of non-destructive testing methods suitable for zirconium alloy specimens.

Another area of interest is in design, manufacturing, and materials technology; in particular, there are programs on the properties of welded joints, heat treatment and forming studies.

The departmental laboratories are well equipped for the various research activities described above, and these are supported by a machine shop, electronics shop, and extensive computing facilities mentioned earlier.

The extensive laboratory facilities of the National Research Council, and of the Department of Resources Canada are also used, by special arrangement, for research and graduate studies of mutual interest. Strong contacts are maintained with the gas turbine, aircraft, and nuclear power industries.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

FW,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

#### Engineering 88.500F1 (MCG5300) Fundamentals of Fluid Dynamics

Differential equations of motion. Viscous and inviscid regions. Potential flow: superposition; thin airfoils; finite wings; compressibility corrections. Viscous flow: thin shear layer approximation; laminar layers; transition; turbulence modelling. Convective heat transfer: free versus forced convection; energy and energy integral equations; turbulent diffusion. Also offered at the undergraduate level, with different requirements, as Engineering 87.432★, for which additional credit is precluded.

#### Engineering 88.501W1 (MCG5301)

##### Theory of Viscous Flows

Navier-Stokes and boundary layer equations; mean flow equations for turbulent kinetic energy; integral formulations. Stability, transition, turbulence, Reynolds stresses; separation. Calculation methods, closure schemes. Compressibility, heat transfer, and three-dimensional effects.

#### Engineering 88.503F1 (MCG5303)

##### Incompressible Non-Viscous Flow

The fundamental equations and theorems for non-viscous fluid flow; solution of two-dimensional and axisymmetric potential flows; low-speed airfoil and cascade theory; wing lifting-line theory; panel methods.

#### Engineering 88.504F1 (MCG5304)

##### Compressible Non-Viscous Flow

Steady isentropic, frictional, and diabatic flow; shock waves; irrotational compressible flow, small perturbation theory and similarity rules; second-order theory and unsteady, one-dimensional flow.

#### Engineering 88.508W1 (MCG5308)

##### Experimental Methods in Fluid Mechanics

Fundamentals of techniques of simulation of fluid dynamic phenomena. Theoretical basis, principles of design, performance and instrumentation of ground test facilities. Applications to aerodynamic testing.

#### Engineering 88.509W1 (MCG5309)

##### Environmental Fluid Mechanics Relating to Energy Utilization

Characteristics of energy sources and emissions into the environment. The atmosphere; stratification and stability, equations of motion, simple winds, mean flow, turbulence structure and dispersion near the ground. Flow and dispersion in groundwater, rivers, lakes and oceans. Physical and analytical modelling of environmental flows.

#### Engineering 88.510W1 (MCG5310)

##### Performance and Economics of Aircraft

Aircraft performance analysis with emphasis on factors affecting take-off, landing and economic performance; high lift schemes; operating economics.

#### Engineering 88.511F1 (MCG5311)

##### Dynamics and Aerodynamics of Flight

Static stability theory. Euler's equations for rigid body motion; the linearized equations of motion; stability derivatives and their estimation. Longitudinal and lateral dynamic response of an aircraft to control and disturbance. Also offered at the undergraduate level, with different requirements, as Engineering 87.438★, for which additional credit is precluded.



Engineering 88.514F1 (MCG5314)

### **Ground Transportation Systems and Vehicles**

Performance characteristics, handling and directional stability, ride comfort and safety of various types of ground vehicle systems including road vehicles, terrain-vehicle systems, guided transport systems, and advanced ground transport technology.

Engineering 88.515W (MCG5315)

### **Orbital Mechanics and Space Control**

Orbital dynamics and perturbations due to the Earth's figure, the sun, and the moon with emphasis on mission planning and analysis. Rigid body dynamics applied to transfer orbit and on-orbit momentum management and control of spacecraft. Effects of flexible structures on a spacecraft control system.

Engineering 88.517W1 (MCG5317)

### **Experimental Stress Analysis**

Introduction to theory of elasticity. Photoelasticity: types of polariscopes, two- and three-dimensional stress fields, frozen patterns. Photoelastic coatings. Strain gauges; gauge factors, sensitivity, calibration, and temperature compensation. Moiré fringes, brittle lacquers, mechanical strain gauges.

Engineering 88.521W1 (MCG5321)

### **Methods of Energy Conversion**

Technical, economic and environmental aspects of present and proposed large-scale systems of energy conversion.

Engineering 88.530F1 (MCG5330)

### **Engineering Acoustics**

Review of acoustic waves in compressible fluids; acoustic pressure, intensity and impedance; physical interpretation and measurement; transmission through media; layers, in-homogeneous media, solids; acoustic systems; rooms, ducts, resonators, mufflers, properties of transducers; microphones, loudspeakers, computational acoustics.

Engineering 88.531W1 (MCG5331)

### **Aeroacoustics**

The convected wave equation; theory of subsonic and supersonic jet noise; propeller and helicopter noise; fan and compressor noise; boundary layer noise, interior noise; propagation in the atmosphere; sonic boom; impact on environment.

Engineering 88.532F1 (MCG5332)

### **Instrumentation Techniques**

An introduction for the non-specialists to the concepts of digital and analog electronics with emphasis on data acquisition, processing and analysis. Topics covered include operational amplifiers, signal processing, digital logic sys-

tems, computer interfacing, noise in electronic systems. Hands-on sessions illustrate theory and practice.

Engineering 88.534W1 (MCG5334)

### **Computational Fluid Dynamics of Compressible Flows**

Solution techniques for parabolic, elliptic and hyperbolic equations developed for problems of interest to fluid dynamics with appropriate stability considerations. A staged approach to solution of full Euler and Navier-Stokes equations is used. Grid generation techniques appropriate for compressible flows are introduced.

Engineering 88.541F1 (MCG5341)

### **Turbomachinery**

Types of machines. Similarity: performance parameters; characteristics; cavitation. Velocity triangles. Euler equation: impulse and reaction. Radial pumps and compressors: analysis, design and operation. Axial pumps and compressors: cascade and blade-element methods; staging; off-design performance; stall and surge. Axial turbines. Current design practice. Also offered at the undergraduate level, with different requirements, as Engineering 88.435★, for which additional credit is included.

Engineering 88.542W1 (MCG5342)

### **Gas Turbines**

Interrelationship among thermodynamic, aerodynamic, and mechanical design. Ideal and real cycle calculations. Cycle optimization; turbo-shaft, turbojet, turbofan. Component performance. Off-design performance; matching of compressor, turbine, nozzle. Twin-spool matching.

Engineering 88.543W1 (MCG5343)

### **Advanced Thermodynamics**

The course covers three major topics: review of fundamentals from a consistent viewpoint, properties and equations of state, and applications and special topics. The third topic includes an introduction to statistical thermodynamics.

Engineering 88.547W1 (MCG5347)

### **Conductive and Radiative Heat Transfer**

Analytical, numerical and analog solutions to steady-state and transient conduction heat transfer in multi-dimensional systems. Radiative heat exchange between black, grey, non-grey diffusive and specular surfaces, including effects of athermanous media.

Engineering 88.548W1 (MCG5348)

### **Convective Heat and Mass Transfer**

Analogies between heat, mass and momentum transfer. Forced and free convection relations for laminar and turbulent flows ana-

lytically developed where possible and otherwise deduced from experimental results, for simple shapes and in heat exchangers. Mass transfer theory and applications.

Engineering 88.550W1 (MCG5350)

**Advanced Vibration Analysis**

General theory of continuous and discrete multi-degree-of-freedom vibrating systems. Emphasis on numerical techniques of solving complex vibrating systems, with selected applications from aerospace, civil, and mechanical engineering.

Engineering 88.552W1 (MCG5352)

**Optimal Control Systems**

Review of transfer function and state-space system descriptions. Elements of the optimal control problem. Variational calculus. Optimal state feedback control. Riccati equations. Optimal observers and Kalman-Bucy Filters. Extension to discrete time systems including an introduction to dynamic programming. Practical applications are emphasized throughout the course.

Engineering 88.553F1 (MCG5353)

**Robotics**

The history of and introduction to robotics methodology. Robots and manipulators; homogeneous transformation, kinematic equations, solving kinematic equations, differential relationships, motion trajectories, dynamics. Control; feedback control, compliance, servomotors, actuators, external and internal sensors, grippers and vision systems. Microprocessors and their application to robot control. Programming.

Engineering 88.554W1 (MCG5354)

**Guidance, Navigation and Control**

Guidance system classification, flight control systems, targeting, target tracking, sensing. Modern multivariable control analysis; design requirements, sensitivity, robustness, perturbations, performance analysis. Modern filtering and estimation techniques. Terrestrial navigation; tactical air navigation (TACAN), star trackers Guidance mission and performance. Aircraft, missile and spacecraft guidance and control.

Engineering 88.555F1 (MCG5355)

**Stability Theory and Applications**

Fundamental concepts and characteristics of modern stability definitions. Sensitivity and variational equations; linear variational equations; phase space analysis; Lyapunov's direct method. Autonomous and nonautonomous systems; stability in first approximation; the effect of force type on stability; frequency method.

Engineering 88.556W1 (MCG5356)

**Neuro and Fuzzy Control**

Knowledge-based controllers. Fuzzy control: mathematics, relations, operations, approximate reasoning. Fuzzy knowledge base control and structure. Fuzzification, inference engine, defuzzification. Nonlinear, adaptive fuzzy control systems. Stability, Neuro-control: processing, learning. Adaptation of artificial neural systems: associative memories, algorithms, applications, and network implementation. Neurofuzzy systems: industrial applications.

Engineering 88.561W1 (MCG5361)

**Creative Problem Solving and Design**

Problem-solving processes and how they can be applied in engineering design. Emphasis on learning methodologies rather than accumulating information. Techniques can be successfully applied in any engineering specialty. (Also listed as Industrial Design 85.531)

Engineering 88.562F1 (MCG5362)

**Failure Prevention (Fracture Mechanics and Fatigue)**

Design of engineering structures to ensure against failure due to fatigue or brittle fracture. Nature of fatigue and brittle fracture; selection of suitable material, geometry, and inspection procedures for the load and environmental conditions.

Engineering 88.563W1 (MCG5381)

**Lightweight Structures**

Structural behaviour. Fundamentals of basic elasticity. Energy methods of structural analysis. Bending, shear, and torsion of open and closed multicell structures. Bending of plates. Structural idealization and its effects on open and closed sections. Structural stability.

Engineering 88.564W1 (MCG5364)

**Computational Metallurgy**

Development of microstructure in alloys in solidification processes and post-solidification processing. Nucleation and growth of solid phase. Formation of a dendrite structure, macro and micro segregations. Pore formation in castings. Thermodynamic and kinetics of phase transformations and structure evolution in solid alloys.

Engineering 88.565F1 (MCG5365)

**Finite Element Analysis I**

An introduction to the finite element methodology, with emphasis on applications to heat transfer, fluid flow and stress analysis. The basic concepts of Galerkin's method, interpolation, numerical integration, and isoparametric elements are taught using simple examples.

Engineering 88.566W1 (MCG5366)

### **Finite Element Analysis II**

Time marching heat flow problems with linear and nonlinear analysis. Static plasticity. Time-dependent deformation problems; viscoplasticity, viscoelasticity, and dynamic analysis. Isoparametric elements and numerical integration are used throughout.

Engineering 88.567F1 (MCG5367)

### **The Boundary Integral Equation (BIE) Method**

Integral equations. The BIE for potential theory and for elastostatics in two-dimensions. Boundary elements and numerical integration schemes. Practical applications.

Engineering 88.568W1 (MCG5368)

### **Advanced Engineering Materials**

The physical metallurgy of important engineering metals and alloys: analytical techniques, crystallography and structure of alloys, dislocation interactions and dissociation, metallurgical thermodynamics and transformations and strengthening mechanisms. Highlights the physical phenomena controlling the properties.

Prerequisite: Engineering 88.270 or the equivalent.

Engineering 88.574W1 (MCG5374)

### **Computer-Integrated Manufacturing Systems (CIMS)**

Topics essential to CIMS including computer graphics, geometric modelling, numerically controlled machining, and flexible manufacturing. The fundamental data structures and procedures for computerization of engineering design, analysis and production. Also offered at the undergraduate level, with different requirements, as Engineering 88.474★, for which additional credit is precluded.

Engineering 88.575F1 (MCG5375)

### **CAD/CAM**

Computer-aided design process, computer graphics including hardware and software standards. Wire frames, boundary representations, constructive solids geometry, sculptured surfaces. Data bases. Graphics and product interchange files. Computer-aided manufacturing; numerical control, CNC, DNC, adaptive control. CAM programming, popular commercial CAD programs. Management issues. Also offered at the undergraduate level, with different requirements, as Engineering 88.475★, for which additional credit is precluded.

Engineering 88.580 (MCG5480I)

### **Special Topics in Mechanical and Aerospace Engineering**

Topic for 1999-2000: Continuum Mechanics with Application to Plasticity. Continuum me-

chanics, primarily from a solid mechanics viewpoint, and elementary plasticity theory. Topics include: tensors, indicial notation and tensor manipulation. Continuum descriptions of deformation, strain and stress. Objective tensors. constitutive relations, elasticity and elementary plasticity. Yield surface, flow potential and normality.

Engineering 88.581 (MCG5489I)

### **Special Topics in Mechanical and Aerospace Engineering**

Topic for 1999-2000: Biomechanics.

Human anatomy and physiology with an emphasis on artificial organ and prosthetic device design requirements. Application of engineering principles to cells and tissues, biofluid mechanics, human body energetics, measurement techniques, mechanics of the musculoskeletal, circulatory and pulmonary systems. Emphasis on the artificial heart. Also offered at the undergraduate level, with different requirements, as Engineering 86.496B, for which additional credit is precluded.

Engineering 88.582 (MCG5483I)

### **Special Topics in Mechanical and Aerospace Engineering**

Topic for 1999-2000: Welding Engineering.

Welding processes and design. Topics include: welding processes and symbols, metallurgical aspects of welding, heat transfer, design and stress analysis, fracture of welds, non-destructive testing and welding codes, welding case studies. Also offered at the undergraduate level, with different requirements, as Engineering 88.496C, for which additional credit is precluded.

Engineering 88.583 (MCG5488I)

### **Special Topics in Mechanical and Aerospace Engineering**

Topic for 1999-2000: Tribology.

Plasma-assisted physical vapour deposition and ion implantation as surface engineering methods. Properties of thin coatings. Wear resistance parameters; hard films such as TiN and carbon-like diamond. Reduction of friction coefficient-thin solid lubricants. Bulk materials. Friction and wear phenomena characterization. Wear processes.

Engineering 88.585 (MCG5482I)

### **Special Topics in Mechanical and Aerospace Engineering**

Topic for 1999-2000: Advanced Space Studies. Space technology, physics and life sciences related to manned spaceflight based upon astronauts' first year of basic training. Topics may include spacecraft design, technical requirements for manned spaceflight, shuttle systems, biology, fluid physics in microgravity, remote sensing from space, aeronomy, and the mobile servicing system. Also offered at



the undergraduate level, with different requirements, as Engineering 86.496A, for which additional credit is precluded.

Engineering 88.586 (MCG5486I)

**Special Topics in Mechanical and Aerospace Engineering**

Topic for 1999-2000: Continuum Thermodynamics. Equilibrium and non-equilibrium thermodynamics as a field theory. Topics include: conditions of equilibrium, Gibbs-Duhem relation, Legendre transforms and their use, Maxwell relations with simple applications, concept of local equilibrium, hydrodynamic equations, phenomenological relations. Applications to both simple and more complex systems.

Prerequisite: Undergraduate courses in matrix algebra, calculus of several variables, ordinary differential equations.

Engineering 88.587 (MCG5387I)

**Special Topics in Mechanical and Aerospace Engineering**

Topic will vary from year to year.

Engineering 88.596F1, W1, S1 (MCG5395)

**Directed Studies**

Engineering 88.598F3, W3, S3 (MCG5398)

**Independent Engineering Study**

Students pursuing a master's degree by course work carry out an independent study, analysis, and solution of an engineering problem or design project. The results are given in the form of a written report and presented at a departmental seminar. Carried out under the general direction of a faculty member.

Engineering 88.599F4, W4, S4

**M.Eng. Thesis**

Engineering 88.699F, W, S

**Ph.D. Thesis**

**Other Courses of Particular Interest**

*Civil and Environmental Engineering*

82.511, 82.512, 82.513, 82.524, 82.534, 82.562

*Mathematics and Statistics*

70.486 Numerical Analysis

70.586

*Physics*

75.447 Statistical Physics

75.511

*Systems and Computer Engineering*

94.501, 94.504, 94.505, 94.541, 94.542, 94.552, 94.553

## Mechanical Engineering (University of Ottawa)

University of Ottawa  
Room A-205 Colonel By Hall  
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Fax: 562-5177

### The Department

**Chair of the Department, B.S. Dhillon**

**Graduate Studies Officer, S. Tavoularis**

The Department of Mechanical Engineering is one of the two constituents of the Ottawa-Carleton Institute for Mechanical and Aerospace Engineering. Consult the Institute entry beginning on page 245 of this Calendar for a faculty list, graduate program descriptions, and admission requirements.

Programs of research and study are offered in several areas. Most research projects in the Department are in the general fields of thermofluids, solid mechanics, materials and design, manufacturing, and industrial engineering. Members of the Department are engaged in research on the following topics: elasticity, plasticity, viscoelasticity, micromechanics of solids, stress analysis of shells, shell dynamics, strength of material, vibration, flow-induced vibration, photo-elasticity and experimental stress analysis, metal forming, plastic deformation and fracture of metals, ceramics and polymers, hot working of metals, welding, time and temperature dependent solid state processes, constitutive relations of plasticity and fracture, fibre composite material pressure vessels and high performance energy storage rotors, automated manufacturing of composites, two-phase heat transfer and fluid flow related to nuclear reactors, two-phase thermosyphons, swirling flow, turbulent flow structure, turbulent diffusion, flow and heat transfer in rod bundles, hemodynamics of cardiac assist devices, infiltration and stack effect in buildings, low Reynolds number flows, flow visualization, heat exchangers, power generation, battery and fuel-cell/flywheel hybrid power train design, liquid fuel combustion, alternate and broad-cut fuel I.C. engine design, integrated computer-aided design systems, computer-aided manufacturing and automation, computer control of mechanical systems, robot design and control, computer vision for control of machines, reliability modelling, human reliability, common-cause failures, transit system reliability, and power production system reliability.

### Research Facilities

Research is conducted in large, modern and well-equipped laboratories containing computerized engine test cells, wind tunnels, water tunnels, towing tanks, two-phase heat transfer and fluid flow loops, submerged arc welders, computer controlled filament winder, material testing apparatus including computer controlled tensile machine, hydraulic fatigue testing machine and impact tester, high-speed data acquisition systems, photo-elastic equipment, shaker table, high-speed rotor testing facility, a selection of mini- and micro-computers, a state of the art CAD/CAM facility, robots, computer controllers, computer controlled machine tools, and a low temperature facility. An AMDAHL 5880 computer is available for advanced degree work.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

Engineering 89.501 (MCG5101)

#### Theory of Elasticity

Analysis of stress and strain. Stress and strain tensors. Yield criteria laws of elasticity and general theorems. Stress functions. Two-dimensional problems in rectangular and polar coordinates. Applications in plates and shells. Strain energy techniques. Application of numerical analysis to elasticity problems.

Engineering 89.502 (MCG5102)

#### Advanced Stress Analysis

Solutions to special beam problems including beams on elastic foundations, curved beams, multi-span beams, etc. as well as some axisymmetric problems. The significance of assumptions is discussed and solution techniques including series solutions and energy methods are utilized.

Engineering 89.503 (MCG5103)

#### Theory of Perfectly Plastic Solids

Elastic behaviour, model materials. Yield criteria and flow laws. Energy principles. Contained plastic deformation. Plane strain. Slipline fields. Applications to metal-forming processes.

Engineering 89.504 (MCG5104)

#### Theory of Plates and Shells

A general coverage of various approaches to plate problems and the application of these

methods to practical cases. A study of the theory of shells including deformation of shells without bending, stresses under various loading conditions, general theory of shells, shells forming surfaces of revolution.

Engineering 89.505 (MCG5105)

**Continuum Mechanics**

Fundamental equations of continuum mechanics. Thermodynamics of continua. Rheological equations. Hamilton's principle for continua. Analytical solution of some elasticity and incompressible fluid dynamic problems. Extension to viscoelasticity and plasticity. Sound waves. Shock waves. Numerical methods of solution.

Engineering 89.506 (MCG5106)

**Advanced Topics in Elasticity**

Algebraic computation software. Curved solids. Governing equations of planar elastostatics in Cartesian coordinates. Governing equations of plates. Linear shell theory in curvilinear coordinates. Introduction to non-linear elastostatics. Non-linear shell theory. Instability of cylindrical shells. Thick and thin shell elastodynamics.

Engineering 89.507 (MCG5107)

**Advanced Dynamics with Applications**

Review of Euler/Newton and D'Alembert formulation, Euler Angles, Gyrodynamics, analysis and response of rotating machinery. Lagrangian dynamics, generalized coordinates, virtual work, generalized forces and the power function. Determination of system constraint forces and equilibrium. Emphasis will be on modelling and formulation of multi-degree-of-freedom vibrational, electro-mechanical, two- and three-dimensional dissipative systems, and other engineering applications.

Engineering 89.508 (MCG5108)

**Finite Element Analysis**

Review of matrix algebra and structural mechanics. Direct and variational approaches in the FE analysis of a continuum. Elastic plane stress, plane strain, axisymmetric and three-dimensional elasticity. Elementary FE programming. Isoparametric concept, conforming and non-conforming elements. Thin and thick plates. Thin and thick shells, axisymmetric shells. Steady-state field problems. Intermediate FE programming. Introduction to FE software. Applications in mechanical engineering.

Engineering 89.509 (MCG5109)

**Advanced Topics in Finite Element Analysis**

Finite elements and their solution techniques. Multilayered plate, shell and continua. Eigenvalue and transient analysis, material and geometric non-linearities. Applications to frac-

ture mechanics. Steady and transient state heat conduction. Potential flow. Creeping flow and incompressible viscous flow with inertia.

Engineering 89.510 (MCG5110)

**Micromechanics of Solids**

Introduction. Cartesian tensor notation. Continuum mechanics versus probabilistic micromechanics. Analysis of stress and strain. Analysis of motion. Classes of materials in micromechanics. Random theory of deformation. The stochastic deformation process. Application to classes of materials in micromechanics. Application to classes of structured solids. Experimental approaches.

Engineering 89.511 (MCG5111)

**Gas Dynamics**

Review of thermodynamics of perfect gases. Conservation equations for compressible flows. Gas flow regimes. Wave propagation in compressible media. Isentropic flow. One-dimensional unsteady flow: method of characteristics. Normal and oblique shock waves. Prandtl-Meyer expansion fans. Nozzle, wind tunnel, shock tube, diffuser and airfoil applications. Ideal gas flow in ducts of variable section, friction, heat addition and heat loss. Multi-dimensional flow and methods of characteristics. Imperfect gas effects, dissociation and ionization. Methods of measurement.

Engineering 89.514 (MCG5114)

**Analysis and Design of Pressure Vessels**

Principles of design, materials, preliminary layout. Elastic analysis of axisymmetric shells. Discontinuity analysis. Numerical methods, nozzle-shell analysis. Plastic collapse, fatigue, fracture, creep, buckling.

Engineering 89.515 (MCG5115)

**Non-Linear Optimization**

Formulation of optimization problems. Unconstrained optimization: direct search techniques, gradient techniques. Constrained optimization: by unconstrained minimization, by direct methods. Mathematical programming. Geometric programming. Dynamic programming. Examples and applications in Mechanical Engineering topics.

Engineering 89.517 (MCG5117)

**Introduction to Composite Materials**

Review of strengthening mechanism in metals and polymers. Fibre-reinforced composite materials: strengthening mechanisms, prediction of strengths and moduli, specific properties, fracture mechanisms, toughness, fatigue, creep, effect of environment; fabrication methods and engineering applications. Laminates; mechanical properties and engineering applications.



Engineering 89.518 (MCG5118)

**Introduction to Plasticity**

The analysis of stress and strain in elastic and plastic continuum. Time independent plastic deformation. The microscopic basis of plastic behaviour. Rate dependent deformation. The effect of temperature. Materials testing. Applications.

Engineering 89.519 (MCG5119)

**Fracture Mechanics**

Stress concentration in elastic and plastic media. The energy condition, crack resistance, compliance, the J. integral. Crack arrest. Plain strain and plain stress behaviour. The microscopic aspects of crack propagation. The effect of temperature. Fatigue, stress corrosion cracking, and creep fracture. Probabilistic fracture.

Engineering 89.526 (MCG5126)

**Deformation of Materials**

The deformation and fracture properties of metals, ceramics and polymers are investigated in low temperature engineering environments. The principles of atomic bond breaking processes as the fundamental physical process of deformation and fracture are studied. Deformation kinetics analysis. Introduction to dislocation theory. The rheological models. The analysis and interpretation of constant strain rate, constant stress and stress relaxation tests in terms of the material structure. Thermal activation analysis. Cyclic loading, hydrostatic pressure effects. The principles and practice of short-term testing and analysis.

Engineering 89.529 (MCG5129)

**Hot Working of Metals**

High temperature mechanical properties in metals. Types of recovery, recrystallization and precipitation in metals and their effects on hot strength and structure. Hot rolling of metals. Selection of rolling schedules. Influence of as-rolled structure on room temperature mechanical properties such as yield, tensile and fracture stresses, impact strength. Roll force calculation. Problems and defects in rolling.

Engineering 89.531 (MCG5131)

**Heat Transfer by Conduction**

Steady one-dimensional systems. Differential equations of Bessel and Legendre. Extended surface. Fourier series and integration of partial differential equations. Steady two-dimensional systems. Steady-state numerical methods. Steady heat source systems. Steady porous systems. Transient systems; heating and cooling, unsteady boundary conditions, stationary and moving sources. Transient numerical method. Experimental analogic method.

Engineering 89.532 (MCG5132)

**Heat Transfer by Convection**

General problems of convection. Fundamental equations. Boundary layer equations. Forced convection in laminar flow. Forced convection in turbulent flow. Free convection. Condensing and boiling. Heat transfer to liquid metals. Heat transfer in high-speed flow. Special topics.

Engineering 89.533 (MCG5133)

**Heat Transfer by Radiation**

Thermal radiation and radiation properties. Radiant interchange among surfaces separated by radiatively non-participating media. Radiant energy transfer through absorbing, emitting and scattering media. Combined conduction and radiation. Combined convection and radiation.

Engineering 89.534 (MCG5134)

**Heat Transfer with Phase Change**

Pool boiling. Hydrodynamics of two-phase flow. Flow boiling and flow boiling crisis. Instability of two-phase flow. Condensation.

Engineering 89.536 (MCG5136)

**Special Studies in Fluid Mechanics and Heat Transfer**

Current topics in the field.

Engineering 89.537 (MCG5137)

**Special Studies in Solid Mechanics and Materials**

Current topics in the field.

Engineering 89.538 (MCG 5138)

**Advanced Topics in Mechanical Engineering**

Current topics in the field.

Engineering 89.541 (MCG5141)

**Statistical Thermodynamics**

Kinetic theory of an ideal gas. The distribution of molecular velocities. Transport phenomena. Maxwell-Boltzmann statistics. Quantum mechanics. Quantum statistics. Partition functions. Partition functions and thermodynamic properties. Derivations of specific heats of gases. Gas mixtures. Law of mass action.

Engineering 89.548 (MCG5551)

**Théorie d'Écoulement Visqueux**

Dérivation des solutions exactes des équations de Navier-Stokes. Écoulement à petit nombre de Reynolds. Écoulement de Stokes. Écoulement d'Oseen. Théorie de lubrification. Couches limites laminaires. Introduction à la stabilité hydrodynamique.

Engineering 89.549 (MCG5552)

**Théorie de Turbulence**

Révision des théories fondamentales et des résultats expérimentaux des écoulements turbulents. Théorie universelle de l'équilibre,

théorie isotropique locale. Turbulence isotropique, contrainte homogène des écoulements, écoulements turbulents dans les tuyaux et les canaux, jets, sillages, couches limites. Diffusion turbulente. Modèles de turbulence.

Engineering 89.550 (MCG5557)

**Méthodes Numériques en Mécanique des Fluides**

Équations primitives. Méthodes de base à différences finies. Méthodes intégrales. Critère de stabilité. Calcul des écoulements transitoires laminaires tri-dimensionnels. Méthodes MAC de Los Alamos. Calcul des écoulements multidimensionnels turbulents. Modèles de turbulence différentielle (K-E). La méthode numérique de Gosman. Exemples de programmation et de vérification des problèmes exemples.

Engineering 89.551 (MCG5151)

**Laminar Flow Theory**

Derivation and exact solutions of the Navier-Stokes equations. Low Reynolds number flows, Stokes flow. Oseen flow, lubrication theory. Laminar boundary layers. Introduction to hydrodynamic stability.

Engineering 89.552 (MCG5152)

**Theory of Turbulence**

Review of the basic theories and experimental results of turbulent flow. Universal equilibrium theory, locally isotropic theories, isotropic turbulence, homogeneous shear flow, turbulent pipe and channel flow, jets, wakes, boundary layers. Turbulent diffusion of passive contaminants. Modelling of turbulence.

Engineering 89.555 (MCG5155)

**Inviscid Flow Theory**

Langrangian and Eulerian description of fluid motion. Euler equations, velocity potential, irrotational flow, stream function, singular flows. Conformal mapping, Schwarz-Christoffel theorems. Airfoil theory, circulation and lift.

Engineering 89.556 (MCG5156)

**Measurement in Fluid Mechanics**

Review of the common experimental techniques used in fluid mechanical research and applications. Flow visualization techniques. Hot-wire anemometry. Laser-Doppler anemometry. Measurement of concentration, temperature, force, pressure.

Engineering 89.557 (MCG5157)

**Numerical Computation of Fluid Dynamics and Heat Transfer**

Governing equations for fluid flow, heat transfer, and chemical species. Explicit, implicit, finite difference and control volume procedures for approximating the parabolic and

elliptic sets of partial differential equations and boundary conditions. Numerical solution by direct and iterative Gauss-Seidel relaxation methods. Considerations of stability, convergence, and numerical diffusion. Computational problems.

Engineering 89.558 (MCG5158)

**Industrial Fluid Mechanics**

Application of simple flows to analysis of more complex systems. Pipe and duct systems, flow separation and control, aerosols, separation of particulates from flow, cavitation, unsteady flow.

Engineering 89.559 (MCG5159)

**Advanced Production Planning and Control**

The principles of production management. Methods engineering, manufacturing control. Recording and evaluation of operations. Financial and production planning. Inventory control. Automation. Factory planning.

Engineering 89.561 (MCG5161)

**Environmental Engineering**

Thermodynamic considerations. Physiological reactions of humans to different environments. Principles of ventilation, distribution and cleaning of air. Illumination and acoustics.

Engineering 89.568 (MCG5168)

**Industrial Organization**

Principles of organization. Production processes. Organization and planning production. Evaluation of production activities. The economics of production. Planning for economy. Information engineering. Standardization.

Engineering 89.569 (MCG5169)

**Advanced Topics in Reliability Engineering**

Overview of classical reliability concepts. Fault tree construction and evaluation. Common-cause failure analysis of engineering systems. Human reliability modelling in engineering systems. Human unreliability data banks. Three state device systems. Delta-star and Mellin transforms reliability determination techniques. Models to compute reliability of on-surface transportation vehicles. Reliability techniques applications in advanced engineering systems.

Engineering 89.570 (MCG5170)

**CAD/CAM**

Current technologies of CA drafting: hardware and software. Design software description: optimization, analysis, and graphical representation. Current technologies of CAM hardware (NC machines, robots, and automated transportation systems) and computer-process interface and control. Introduction to group technology, CA process planning, and

CA quality control. Course is project oriented with hands-on experience.

Engineering 89.571 (MCG5171)

**Applied Reliability Theory**

Coherent systems. Paths and cuts representation. State-space representation. Observability and controllability. Failure rate. Repair time. System reliability estimation: binomial model. Strength stress model. Failure detection and isolation. Multiple sensors. Model based methods. Expert system approach. Analytical redundancy. Applications.

Engineering 89.572 (MCG5172)

**Introduction to Management of Automation (Robotics and Numerical Control)**

Administrative concept of automation, robotics and numerical control; elements of flexible manufacturing systems. Process design in automation. Role of automation in the administration of manufacturing and project engineering. Optimization in the design of computer assisted manufacturing (CAM). State of art review.

Engineering 89.573 (MCG5173)

**Systems Engineering and Integration**

State space representation. Observability, controllability, state estimation. Parameter identification. Steady-state and transient performance. Stability. Monitoring and regulation. Discretization effects. System integration. Bandwidth coordination. Technological systems design examples.

Engineering 89.576 (MCG5176)

**Industrial Control Systems**

Concept, analysis and design of classical and modern industrial control systems: classical control systems; design of electro-mechanical servo-systems and process controllers. Modern control system applications; basic techniques in the use of microprocessors. Microprocessor/microcomputer based control systems for robotics, automation, manufacturing and instrumentation applications. Design project of industrial control and automation systems. Not accessible to students who have taken MCG 4108.

Engineering 89.577 (MCG 5177)

**Robot Mechanics**

Robotics overview. Transformations. Basics of robot kinematics, statics and dynamics. Introduction to practical robots, control and programming. Project in analysis, design or application of manipulators. Not accessible to students who have taken MCG 4132.

Engineering 89.578 (MCG5178)

**Advanced Topics in CAD/CAM**

Overview of totally integrated CAD/CAM systems. Details of design and manufacturing

software tools. Methods of linking design and manufacturing tools to form an integrated CAD/CAM system. Students will undertake projects which will provide them with hands-on experience.

Engineering 89.579 (MCG5179)

**Flexible Manufacturing**

Types of manufacturing systems. The concept of flexible manufacturing. Overview of the basic components of flexible manufacturing systems: NC machine tools, programmable manipulators, guided vehicles, storage and retrieval warehouses. Machine cells. System layout and reliability. Group technology. Workpieces and tools' routing. Operations sequencing.

Engineering 89.580 (MCG5180)

**Advanced Topics in Composite Materials**

Computer automated manufacturing techniques. Advanced topics in lamination theory. Interlaminar stresses and free edge effects. Lamina and laminate failure theories. Principles of non-destructive testing including damage assessment. Mechanics and failure of particle, flake, thermoplastic and metal matrix composites.

Engineering 89.581 (MCG5181)

**Advanced Vibrations**

Kinematics of vibrations, the single-degree-of-freedom system, without and with damping, two degrees of freedom, several degrees of freedom, vibration of shafts, critical speeds, complex presentation, influence coefficients, matrix method, stability of solution, approximate methods.

Engineering 89.582 (MCG5182)

**Theory of Elastic Instability**

Considerations of instability with respect to small deformation. Differential equations for linear elements. Conservative and non-conservative force systems. Energy methods. Instability due to torsional and lateral forces in beams. Instability of elements curved in a plane. Applications of trigonometric series in the above problems. Stability of linear members in the inelastic zone.

Engineering 89.585 (MCG5185)

**Multivariable Digital Control**

Quantization. Z-Transform. State equations. Jordan canonical form. Multirate and nonsynchronous samplings. Controllability and observability of digital systems. Digital controllers design using bilinear transformation. Digital PID controller. Stability. Optimal control of digital systems. Examples of controlling mechanical system actuators.



Engineering 89.586 (MCG5186)

**Non-Linear Discontinuous Dynamics and Control**

Hamiltonian dynamics. Hamiltonian control systems. Lyapunov dynamics. Decoupling. Phase space analysis. Switching and sliding mode control. Boundary layer continuous approximation. Actuator, sensors and controller requirements. Manipulation control examples.

Engineering 89.591 (MCG5191)

**Combustion in Premixed Systems**

Stoichiometry, thermo-chemistry, ignition, flame propagation, flame stabilization, diffusion flames, turbulent combustion, modeling.

Engineering 89.592 (MCG5192)

**Combustion in Diffusion Systems**

Gaseous jet flames, combustion of liquid droplets, atomization, spray flames, coal combustion, fluidized bed combustion.

MCG 6000

**Mechanical Engineering Report**

For students in the course work master's program working on the Engineering Report.

MCG 7999

**M.A.Sc. Thesis**

For students working towards their master's thesis.

MCG 9997

**Preparation for Ph.D. Thesis Proposal.**

Following completion of the comprehensive examination, registration required for all Ph.D. candidates until the thesis proposal is accepted by the advisory committee.

MCG 9998

**Preparation for Ph.D. Comprehensive Examination**

Registration required for all Ph.D. candidates until the comprehensive examination is passed.

MCG 9999

**Ph.D. Thesis**

For students working towards their Ph.D. thesis.

## School for Studies in Art and Culture: Music

Loeb Building A911  
Telephone: 520-5770  
Fax: 520-3905

### The School

St. Patrick's Building 423

Director, Bryan Gillingham

Assistant Director (Music), Bryan Gillingham

Music offers courses at the graduate level in musicology and ethnomusicology. These include courses offered in cooperation with the School of Canadian Studies. Full use is made of the resources of the National Library, the Public Archives, and the National Museum of Civilization.

Dr. Elaine Keillor is lecturer in Canadian music with Dr. Helmut Kallmann (former Chief Music Librarian, National Library) as Adjunct Professor.

Courses in the sociology and aesthetics of music are offered by Dr. John Shepherd and Dr. Geraldine Finn.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Music 30.501W1

#### Theories of Music as Culture

This course provides a critical survey of major theories on the relationship between music and culture. Particular attention is paid to the way in which work in musicology, ethnomusicology, culture theory, feminism, semiotics, structuralism, poststructuralism, and psychoanalytic theory has been applied to the problem of understanding the culture-specific character of sound in music.

Prerequisite: Permission of the School for Studies in Art and Culture (Music).

Music 30.505F1

#### Feminism and Musicology

This course applies the insights and analyses of feminist cultural critiques to the theory and practice of music and musicology. Taking specific discursive and musical examples as its focus, the course draws upon recent developments in psychoanalytic theory, deconstruction, and post-colonial critique to examine the structures and significances of music in contemporary culture and its relationship to politics, ideology, and power. Prerequisite: Permission of the School for Studies in Art and Culture (Music).

Music 30.510T2

#### History of Canadian Music I

Selected aspects of notated Canadian music from 1600 to the present; liturgical music; social and economic conditions of Canadian musical life; regional studies; individual composers and performers.

Prerequisite: Permission of the School for Studies in Art and Culture (Music).

Music 30.511F1

#### History of Canadian Music II

Anglo- and Franco-folk music traditions in Canada, past and present.

Prerequisite: Permission of the School for Studies in Art and Culture (Music).

Music 30.512W1

#### History of Canadian Music III

The music of various ethnic minorities in Canada with special emphasis on the traditions of the First Peoples.

Prerequisite: Permission of the School for Studies in Art and Culture (Music).

Music 30.515F1

#### History of Canadian Music IV

A survey of the history of French-Canadian popular music from the beginnings of Nouvelle France to the present. Special attention is paid to the social and political contexts of music making in Québec.

Prerequisites: Permission of the School for Studies in Art and Culture (Music). A good reading ability in French is essential.

## Neuroscience

Life Sciences Research Building 325  
 Telephone: 520-4017  
 Fax: 520-3667  
 E-mail: kim\_cook@carleton.ca

### The Institute

**Director,** J.B. Kelly

Neuroscience is an emerging academic discipline that includes physiological, anatomical, biochemical, and behavioural studies of the nervous system. At Carleton University, neuroscience research and graduate training are coordinated by the Institute of Neuroscience. Both M.Sc. and Ph.D. degrees, with a Specialization in Neuroscience, are offered through either the Departments of Biology or Psychology with supervision by one of the faculty members of the Institute. Application for admission, scholarships, and teaching assistantships should be made through either the Departments of Biology or Psychology depending on background and interests of the student. Further information about the degree programs may be obtained from the director of the Institute of Neuroscience or the supervisor of graduate studies in either Biology or Psychology.

#### Members of the Institute

- \* Hymie Anisman, *Stress, Brain-Immune Interactions, Depression*
- \* S.A.L. Bennett, *Progressive Neurodegeneration, Neuronal Apoptosis*
- \* John Durkin, *Neurochemistry, Cell Signalling, Cerebral Ischemia* (Adjunct)
- \* Phillip Hicks, *Neural Plasticity, Somatosensory and visual Cortex* (Adjunct)
- \* Bin Hu, *Thalamic Neurophysiology, Synaptic Signalling* (Adjunct)
- \* J.B. Kelly, *Central Auditory System, Electrophysiology and Behaviour*
- \* D.C. McIntyre, *Epilepsy, Kindling, Learning and Memory*
- \* B.A. Pappas, *Brain Development and Aging, Alzheimer's Disease*
- \* D.C.S. Roberts, *Mechanisms of Drug Abuse and Reinforcement*
- \* Shu Hui Wu, *Auditory Brainstem, Brain Slice Neurophysiology*
- \* Robert M. Zacharko, *Intracranial Self-stimulation, Stress, Depression, Dopamine, Anhedonia*

## The Specialization in Neuroscience

**Coordinator of the Specialization,** J.B. Kelly

The University of Ottawa and Carleton University jointly offer a multi-disciplinary Specialization in Neuroscience. The Specialization is intended to augment the research and training which the student receives through his or her primary department. The degree will in each case specify the discipline of the participating unit with Specialization in Neuroscience. The participating departments are:

- \* Department of Anatomy and Neurobiology, University of Ottawa
- \* Department of Biology, Carleton University
- \* Department of Biology, University of Ottawa
- \* Department of Pharmacology, University of Ottawa
- \* Department of Physiology, University of Ottawa
- \* Department of Psychology, Carleton University
- \* School of Psychology, University of Ottawa

Four clinical departments from the University of Ottawa Medical School are also affiliated.

- \* Department of Medicine (Division of Neurology)
- \* Department of Pathology and Laboratory Medicine (Neuropathology)
- \* Department of Psychiatry
- \* Department of Surgery (Division of Neurosurgery)

Application should be made to the primary department which is most appropriate to the student's research interest. Once accepted by the department, students must be sponsored by a member of the neuroscience faculty.

Application forms and further information can be obtained by writing directly to any of the primary departments.

### Master's Program

#### Admission Requirements

The requirements for admission to the master's neuroscience specialization are as follows:

- \* Prior admission to the master's program of the primary department which participates in the specialization



## Neuroscience

\* A letter of recommendation from a participating faculty member of the neuroscience specialization, indicating the willingness of the faculty member to supervise the candidate's research program

Students with less than a high honours average in their undergraduate and graduate courses will not normally be recommended for admission.

### Program Requirements

The Specialization requires that, in addition to fulfilling the requirements for the master's program of the department in which they are enrolled, the student must successfully complete Psychology 49.520. The thesis research must concern a neuroscience topic and must be supervised by a member of the neuroscience faculty.

### Doctor of Philosophy

#### Admission Requirements

Admission requirements to the Ph.D. neuroscience specialization are as follows:

\* Prior admission to the Ph.D. program of the primary department which participates in the specialization

\* A letter of recommendation from a participating faculty member of the neuroscience specialization, indicating the willingness of the faculty member to supervise the candidate's research program

\* Two additional letters of recommendation from University faculty who are familiar with the candidate's academic and research career

\* Students with less than a high honours standing in their undergraduate and graduate courses will not normally be recommended for admission.

Selection of master's and doctoral students is carried out by the neuroscience specialization coordinating committee which will select and rank the admissible candidates. Admission is determined by priority of ranking, and the number of admissions depends upon the available positions in the specialization.

### Program Requirements

Students must fulfill the Ph.D. program requirements of the department in which they are enrolled. The requirements for the specialization also include the following, some of which may satisfy the Ph.D. requirements of the participating departments:

\* Successful completion of the following neuroscience courses:

Psychology 49.520 and 49.620 and Biology 61.623 and 61.624

\* A thesis in the area of neuroscience, which must be defended at an oral examination

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Neuroscience courses are available through the primary departments. Course offerings vary slightly from year to year and a complete listing can be obtained from the specialization coordinator.

The following are the core courses of the curriculum.

Psychology 49.520T2 (PSY6201)

#### Basics of Neuroscience

A comprehensive neuroscience course from membrane and cellular levels to neural systems and behaviour. Lectures and tutorials will cover such aspects of neuroscience as neuroanatomy, neurophysiology, behavioural neuroscience and neuropharmacology. (Also listed as Biology 61.534)

Biology 61.623F1

#### Neuroscience Techniques I

Completion of a research project carried out under the supervision of a neuroscience faculty member. Students may carry out their project in any department participating in the neuroscience specialization provided they have approval from the administrative head of their particular program. For example, students in the neuroscience specialization must obtain approval from the neuroscience committee. Students in the biopsychology concentration must obtain approval from the Department of Psychology. The purpose of the course is to grant credit for learning new research techniques. (Also listed as Psychology 49.624)

Biology 61.624W1

#### Neuroscience Techniques II

Completion of a research project carried out under the supervision of a neuroscience fac-

ulty member. Students may carry out their project in any department participating in the neuroscience specialization provided they have approval from the administrative head of their particular program. For example, students in the neuroscience specialization must obtain approval from the neuroscience committee. Students in the biopsychology concentration must obtain approval from the Department of Psychology. The purpose of the course is to grant credit for learning new research techniques. (Also listed as Psychology 49.625)

Psychology 49.620T2

**Advanced Seminar in Neuroscience**

A comprehensive proseminar covering specialized topics in neuroscience and biopsychology. The presentations will focus on the active research areas and interests of faculty members and will provide an in-depth coverage of research strategies, methods and results. Graduate student presentations of current research projects will be an integral part of the course. (Also listed as Biology 61.633). Prerequisite: Psychology 49.520.

## Philosophy

Dunton Tower 2123  
Telephone: 520-2110

### The Department

**Chair of the Department,** Jay Drydyk

**Supervisor of Graduate Studies,** Marvin Glass

The Department of Philosophy offers programs of study leading to the degree of Master of Arts.

### Qualifying-Year Program

Applicants who do not hold an Honours degree (or the equivalent) will be required to register in a qualifying-year program before proceeding to the master's program.

The regulations governing the qualifying year are outlined in the General Regulations section of this Calendar (see p. 50).

### Master of Arts

#### Admission Requirements

The minimum requirement for admission to the master's program is an Honours B.A. degree (or the equivalent) in Philosophy, with at least B+ standing (or the equivalent).

Qualifying-year and M.A. applicants from an institution other than Carleton University must submit two papers.

#### Program Requirements

The specific program requirements for master's candidates are the following:

- \* Philosophy 32.580
- \* A thesis equivalent to 2.0 credits, which must be defended at an oral examination; or a research essay equivalent to 1.0 credit
- \* 2.0 credits (or 3.0 in the case of students following the research essay option), a minimum of 1.0 by tutorial, in at least three of the following study areas: studies in the history of philosophy; studies in the work of an individual philosopher; studies in logic, epistemology, or metaphysics; studies in selected problems in philosophy.

#### Guidelines for Completion of Master's Degree

Full-time students enrolled in the 5.0 credit M.A. program are expected to complete Philosophy 32.580 and 2.0 credits by the end of

the second term of study. The thesis or research essay approval form should be submitted by the end of the fourth week of the third term of study. Those students choosing the research essay option should complete 1.0 additional credits by the end of the third term of study. All full-time students are expected to submit the thesis or research essay by the end of the fourth term of study.

Part-time students enrolled in the 5.0 credit M.A. program are expected to complete Philosophy 32.580 and 2.0 credits by the end of the third year of study. The thesis or research essay approval form should be submitted by the end of the second month of the fourth year of study. Those students choosing the research essay option should complete 1.0 additional credit by the end of the fourth year of study. All part-time students are expected to submit the thesis or research essay by the end of the fifth year of study.

### Other Courses

A maximum of 1.0 credit may be selected from courses offered at the 400-level, or in a related field, or at another university.

Each year, the department offers 400-level undergraduate 0.5 credit courses, which are open to students in the qualifying year and, with permission, to students in the M.A. program. For courses offered in 1999-2000, please consult the Undergraduate Calendar.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

FW,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

The following graduate courses are open to students in the M.A. program and, with permission, to students in the qualifying-year program. In tutorial courses, at least five two-hour tutorial sessions will be required.

#### Tutorial Courses

Philosophy 32.504F1

**Tutorial in the History of Philosophy I**

Detailed study of a period or issue in the history of philosophy.



Philosophy 32.505W1

**Tutorial in the History of Philosophy II**

Detailed study of a period or issue in the history of philosophy.

Philosophy 32.514F1

**Tutorial in the Work of an Individual Philosopher I**

A critical and systematic study of the work of an individual philosopher.

Philosophy 32.515W1

**Tutorial in the Work of an Individual Philosopher II**

A critical and systematic study of the work of an individual philosopher.

Philosophy 32.524F1

**Tutorial in Logic, Epistemology, or Metaphysics I**

An attempt to find a solution to a specific problem in logic, epistemology, or metaphysics.

Philosophy 32.525W1

**Tutorial in Logic, Epistemology, or Metaphysics II**

An attempt to find a solution to a specific problem in logic, epistemology, or metaphysics.

Philosophy 32.534F1

**Tutorial in Selected Problems of Philosophy I**

An attempt to find a solution to a specific problem in some area other than logic, epistemology, or metaphysics.

Philosophy 32.535W1

**Tutorial in Selected Problems of Philosophy II**

An attempt to find a solution to a specific problem in some area other than logic, epistemology, or metaphysics.

**Seminar Courses**

Philosophy 32.510F1

**Advanced Problems in Legal Philosophy**

Studies in legal theory and analyses of law advanced by Hart, Dworkin, and others, and legal concepts: for example, principles, rights, duties, liability, etc. Precise course content will vary from year to year and will be announced at the beginning of the term. (Also listed as Law 51.510)

Prerequisites: Philosophy 32.311★ and 32.312★ (Law 51.311★ and 51.312★), or permission of the relevant department.

Philosophy 32.520F1 or W1

**Seminar in Philosophy of Mind and/or Philosophical Semantics**

A detailed study of an issue or the work of selected philosophers in the general area of

philosophy of mind and/or philosophical semantics. Also offered at the undergraduate level, with different requirements, as Philosophy 32.413★ or 32.414★, for which additional credit is precluded.

Philosophy 32.530F1 or W1

**Seminar in Value Theory**

A detailed study of an issue or the work of selected philosophers in the general area of value theory. Also offered at the undergraduate level, with different requirements, as Philosophy 32.415★ or 32.416★, for which additional credit is precluded.

Philosophy 32.540F1 or W1

**Seminar in German Idealism, Its Influence and/or Reactions to It**

A detailed study of an issue or the work of selected philosophers in the general area of German idealism, its influence and/or reactions to it. Also offered at the undergraduate level, with different requirements, as Philosophy 32.406★, for which additional credit is precluded.

Philosophy 32.580T2

**Graduate Seminar**

The first term will be devoted to a single issue or group of interrelated issues. In the second term, a variety of topics will be discussed. Issues covered in this course will vary from year to year.

Philosophy 32.598F2, W2, S2

**Research Essay**

Philosophy 32.599F4, W4, S4

**M.A. Thesis**

## Ottawa-Carleton Institute for Physics

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Université d'Ottawa  
University of Ottawa



Carleton University

### The Institute

**Director of the Institute, Dean Karlen**

**Associate Director, Ivan L'Heureux**

Students pursuing studies in physics at the M.Sc. and Ph.D. levels in the Ottawa area do so in a cooperative program that combines the resources of the Departments of Physics of Carleton University and the University of Ottawa. The two universities have a joint committee supervising the programs, regulations, and student admissions.

Students are admitted for graduate work under the general regulations of the Institute, which include criteria related to academic performance, research experience, and referees' appraisals. The choice of program and/or research project and supervisor will determine the student's primary campus location.

At Carleton, the research areas of physics available for programs leading to the M.Sc. or the Ph.D. degree include high energy physics and medical physics. In high energy physics, both theoretical and experimental programs are available. At the University of Ottawa, the research interests include condensed matter physics, biophysics, non-linear dynamics, statistical mechanics, materials science, and surface physics. The graduate courses offered on the two campuses match this complementarity of research interests, and the courses listed below are therefore grouped to reflect the different emphases on the two campuses.

In addition, the M.Sc. degree in the area of physics in modern technology is offered at both campuses. This program requires a work term placement rather than a thesis.

The list below of all members of the Institute along with their research interests can be used as a guide to possible supervisors. For students in the medical physics stream, research supervision may be provided by members of other institutions in the area, such as hospitals, cancer clinics, and government laboratories.

Requests for information and completed applications should be sent to the Director or Associate Director of the Institute.

### Members of the Institute

The home department of each member of the Institute is indicated by (C) for the Department of Physics, Carleton University and (O) for the Department of Physics, University of Ottawa.

- \* J.C. Armitage, *High Energy Physics, Instrumentation* (C)
- \* Ian Calder, *Experimental Condensed Matter* (O-Adjunct)
- \* Ian Cameron, *Medical Physics* (C-Adjunct)
- \* R.K. Carnegie, *Experimental High Energy Physics* (C)
- \* Sylvain Charbonneau, *Semiconductor Physics* (O-Adjunct)
- \* R.L. Clarke, *Medical Physics* (C-Adjunct)
- \* Joanna Cygler, *Medical Physics* (C-Adjunct)
- \* Serge Desgreniers, *High Pressure Physics* (O)
- \* Marie D'Iorio, *Condensed Matter* (O-Adjunct)
- \* Madhu Dixit, *Experimental High Energy Physics* (C-Adjunct)
- \* K.W. Edwards, *Experimental High Energy Physics* (C)
- \* P.G. Estabrooks, *Experimental High Energy Physics* (C-Adjunct)
- \* Simon Fafard, *Semiconductor Physics* (O-Adjunct)
- \* Emery Fortin, *Semiconductor Physics* (O)
- \* L.H. Gerig, *Medical Physics* (C-Adjunct)
- \* Stephen Godfrey, *Theoretical Particle Physics* (C)
- \* C.L. Greenstock, *Medical Physics* (C-Adjunct)
- \* C.K. Hargrove, *Experimental High Energy Physics* (C-Adjunct)
- \* Pawel Hawrylak, *Theoretical Condensed Matter* (O-Adjunct)
- \* R.J. Hemingway, *Experimental High Energy Physics* (C-Adjunct)
- \* Brian Hird, *Ion Physics* (O-Adjunct)
- \* R.J.W. Hodgson, *Theoretical Nuclear Physics* (O)
- \* B.J. Jarosz, *Medical Physics* (C)
- \* P.C. Johns, *Medical Physics* (C)
- \* Béla Joós, *Theoretical Condensed Matter* (O)
- \* Pat Kalyniak, *Theoretical Particle Physics* (C)
- \* D.A. Karlen, *Experimental High Energy Physics* (C)

- \* Gilles Lamarche, *Low Temperature Physics* (O-Adjunct)
- \* M.A.R. LeBlanc, *Superconductivity* (O)
- \* Ivan L'Heureux, *Nonequilibrium Processes in Nonlinear Systems* (O)
- \* B.A. Logan, *Nuclear Physics* (O)
- \* André Longtin, *Nonlinear Dynamics, Biophysics* (O)
- \* M.J. Losty, *Experimental High Energy Physics* (C-Adjunct)
- \* Paul Marmet, *Atomic and Molecular Physics* (O-Adjunct)
- \* Barry McKee, *Medical Physics* (C-Adjunct)
- \* H.J.A.F. Mes, *Experimental High Energy Physics* (C-Adjunct)
- \* Cheng Ng, *Medical Physics* (C-Adjunct)
- \* Tony Noble, *Experimental High Energy Physics* (C-Adjunct)
- \* F.G. Oakham, *Experimental High Energy Physics* (C-Adjunct)
- \* Peter Piercy, *Condensed Matter Physics* (O)
- \* G.P. Raaphorst, *Medical Physics* (C-Adjunct)
- \* D.G. Rancourt, *Solid State Magnetism* (O)
- \* D.W.O. Rogers, *Medical Physics* (C-Adjunct)
- \* William Romo, *Theoretical Nuclear and Particle Physics* (C)
- \* C.K. Ross, *Medical Physics* (C-Adjunct)
- \* Alain Roth, *Condensed Matter* (O-Adjunct)
- \* Giles Santyr, *Medical Physics* (C)
- \* W.D. Sinclair, *Solar Neutrino Physics* (C-Adjunct)
- \* G.W. Slater, *Polymer Physics* (O)
- \* A.K.S. Song, *Theoretical Studies in Solid State* (O)
- \* Z.M. Stadnik, *Electronic Structure and Magnetism* (O)
- \* M.K. Sundaresan, *Theoretical Particle Physics* (C)
- \* John Tse, *Theoretical Material Sciences* (O-Adjunct)
- \* Y.P. Varshni, *Theoretical Solid State, Astrophysics* (O)
- \* P.J.S. Watson, *Theoretical Particle Physics* (C)
- \* J.C. Woolley, *Semiconductor Physics* (O)

## Master of Science

An Honours B.Sc. in Physics or a closely related field at a standard acceptable to the two universities is normally required for admission to the M.Sc. program. The admissions committee may require students to take an orientation examination during the first weeks of residence. The results of this examination may indicate the need for a student to register in undergraduate courses to fill gaps in his/her knowledge. It is strongly recommended that all students have had at least one course in computing.

## Program Requirements

The options for the M.Sc. program are described below. Normally the requirements for the research M.Sc. with thesis will consist of:

- \* 2.5 credits of course work
- \* A thesis (2.5 credits) defended at an oral examination
- \* Participation in the seminar series of the Institute

Students with academic preparation particularly well suited for their chosen field of study may have their course credit requirements reduced to 2.0 credits. In this case, a 3.0 credit thesis will be required.

The minimum number of courses is 1.5 credits. At least 1.0 credit must consist of lecture courses at the graduate level. The courses 75.590 and 75.591 are courses on Selected Topics, normally given as directed studies, and cannot fulfill this lecture course requirement. Most students will be expected to take 75.502T1. Students in the theoretical or high energy physics streams will normally include 75.561F1, 75.562W1, 75.571F1 and 75.572W1 among their courses.

For the medical physics stream the three areas of specialization are: imaging, therapy, and biophysics. All students are required to take 75.523F1 and 0.5 credit appropriate physics course from an area of physics other than medical physics. In addition:

- \* For imaging, 75.524W1 is required
- \* For therapy, 75.526W1 is required
- \* For biophysics, 0.5 credit chosen from 75.527F1, cell biology, physiology or anatomy is required

Students with a medical/health physics background may have the selection of required courses adjusted to reflect their preparation and may receive advanced standing for equivalent courses.



A selection from 75.528W1, 75.529F1, or, (with approval) other appropriate courses in physics, engineering, computer science, business or law can be used to complete the program.

In special cases, the requirements may also be met by taking 5.0 credits of course work and no thesis. 1.0 credit must be the selected topics course 75.590T2. A comprehensive examination and participation in the seminar series will also be required.

Students in the physics in modern technology stream must successfully complete the following requirements:

- \* 3.0 credits of course work

- \* Physics 75.595F2, W2, S2

- \* Students will normally include 75.502T1 and 74.503 among their courses.

Students enrolled in the physics in modern technology stream are required to complete a work term rather than a research thesis. Students in this stream who wish to pursue a research degree should consult with the graduate supervisor. Although every effort is made to find a work term

position for every student enrolled in the physics in modern technology stream, no guarantee of employment can be made. To minimize the likelihood of a work term position not being found, enrolment will be limited to reflect the availability of work term placements. In the event that a work term placement cannot be found, students may fulfill the M.Sc. requirements with courses only as described above.

Candidates admitted to the M.Sc. program with more than the minimum course requirements may be permitted to credit towards the degree a maximum of 1.0 credit at the senior undergraduate level. This maximum does not apply to qualifying-year students.

### **Guidelines for Completion of Master's Degree**

With the exception of those students in the physics in modern technology stream, full-time master's candidates are expected to complete all requirements in six terms of registered full-time study. Part-time master's candidates are expected to complete their degree requirements within an elapsed period of three to four calendar years after the date of initial registration.

Students in the physics in modern technology stream are normally expected to com-

plete all their requirements in three successive terms of registered full-time study.

## **Doctor of Philosophy**

### **Admission Requirements**

An M.Sc. in Physics, or a closely related field, is normally required for admission into the Ph.D. program. Students who have been admitted to the M.Sc. program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.

In exceptional cases, an outstanding student who has completed the honours B.Sc. will also be considered.

### **Program Requirements (from M.Sc.)**

The normal requirements for the Ph.D. degree (after M.Sc.) are:

- \* A minimum of 2.0 credits at the graduate level

- \* Students who lack any of the relevant courses recommended for the M.Sc. program will be expected to have completed them (or the equivalents) by the end of their Ph.D. program. In addition, students in high energy physics or theoretical physics should complete 75.661 and 75.662.

- \* A comprehensive examination designed to demonstrate overall ability in physics and in the candidate's research area, normally within the first year of study. This takes the form of a written examination followed, if necessary, by an oral examination.

- \* A thesis which will be defended at an oral examination. The examining board for all theses will include members of the Institute from both Departments of Physics. The external examiner of the thesis will be external to both Departments of Physics.

- \* Participation in the seminar series of the Institute

### **Guidelines for Completion of Doctoral Degree**

Full-time Ph.D. candidates admitted on the basis of an M.Sc. are expected to complete all requirements within an elapsed period of four to five years after the date of initial registration. Part-time Ph.D. candidates are expected to complete all requirements within an elapsed period of six years after the date of initial registration.

## Residence Requirements

For the M.Sc. degree:

\* At least one year of full-time study (or the equivalent)

For the Ph.D. degree (from B.Sc.):

\* At least three years of full-time study (or the equivalent)

For the Ph.D. degree (from M.Sc.):

\* At least two years of full-time study (or the equivalent)

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

In the listing below, courses are grouped to reflect the varying research interests of the two universities. If there is small enrollment, a course may be offered as a reading course.

The following course is offered either at Carleton or the University of Ottawa:

Physics 75.571F1 (PHY5170)

### Intermediate Quantum Mechanics with Applications

Angular momentum and rotation operations; Wigner and Racah coefficients; several and many electron problem in atoms; variational and Hartree-Fock formalism; introduction to second quantized field theory; scattering theory.

Prerequisites: Physics 75.477★ and 75.478★ and permission of the Department.

The following courses are offered only at Carleton:

Physics 75.502T1 (PHY5344)

### Computational Physics

Computational methods used in physics research. Introduction to the UNIX operating system. Numerical methods for problems in linear algebra, interpolation, integration, root finding, minimization, and differential equations. Monte Carlo methods for simulation of random processes. Statistical methods for parameter estimation and hypothesis tests. Chaotic dynamics. Also offered at the under-

graduate level, with different requirements, as Physics 75.487★, for which additional credit is precluded.

Prerequisite: An ability to program in FORTRAN, C, or C++ and permission of the Department.

Physics 75.511F1 (PHY8111)

### Classical Mechanics and Theory of Fields

Hamilton's principle; conservation laws; canonical transformations; Hamilton-Jacobi theory; Lagrangian formulation of classical field theory.

Prerequisite: Permission of the Department.

Physics 75.522W1 (PHY8122)

### Special Topics in Molecular Spectroscopy

Topics of current interest in molecular spectroscopy. In past years, the following areas have been covered: electronic spectra of diatomic and triatomic molecules and their interpretation using molecular orbital diagrams; Raman and resonance Raman spectroscopy; symmetry aspects of vibrational and electronic levels of ions and molecules in solids; the presence of weak and strong resonant laser radiation. (Also listed as Chemistry 65.509/CHM8150).

Prerequisite: Permission of the Department.

Physics 75.523F1 (PHY5161)

### Medical Radiation Physics

Basic interaction of electromagnetic radiation with matter. Sources: X-ray, accelerators, nuclear. Charged particle interaction mechanisms, stopping powers, kerma, dose. Introduction to dosimetry. Units, measurements, dosimetry devices.

Prerequisite: Permission of the instructor.

Physics 75.524W1 (PHY5112)

### Physics of Medical Imaging

Outline of the principles of transmission X-ray imaging, computerized tomography, nuclear medicine, magnetic resonance imaging, and ultra-sound. Physical descriptors of image quality, including contrast, resolution, signal-to-noise ratio, and modulation transfer function are covered and an introduction is given to image processing.

Prerequisites: Physics 75.523 and 75.423★, or permission of the Department.

Physics 75.526W1 (PHY5164)

### Medical Radiotherapy Physics

Terminology and related physics concepts. Bragg-Gray, Spencer-Attix cavity theories, Fano's theorem. Dosimetry protocols, dose distribution calculations. Radiotherapy devices, hyperthermia.

Prerequisite: Physics 75.523 and permission of the Department.

Physics 75.527F1 (PHY5165)

**Radiobiology**

Introduction to basic physics and chemistry of radiation interactions, free radicals, oxidation and reduction, G values. Subcellular and cellular effects: killing, repair, sensitization, protection. Measurement methods. Survival curve models. Tissue effects, genetic and carcinogenic effects, mutations, hazards. Cancer therapy. Radiation protection considerations. Prerequisite: Physics 75.523 must have been taken, or be taken concurrently and permission of the Department.

Physics 75.528W1 (PHY5163)

**Radiation Protection**

Biophysics of radiation hazards, dosimetry and instrumentation. Monitoring of sources, planning of facilities, waste management, radiation safety, public protection. Regulatory agencies.

Prerequisite: Physics 75.523 and permission of the Department.

Physics 75.529F1 (PHY5166)

**Medical Physics Practicum**

Hands-on experience with current clinical medical imaging and cancer therapy equipment, and dosimetry and biophysics instrumentation. The course requires completion of experimental projects on medical imaging, radiotherapy, dosimetry, and biophysics, conducted at local clinics and NRC laboratories. Prerequisites: Physics 75.523. Also, as appropriate to the majority of projects undertaken, one of Physics 75.524, 75.526, 75.527, or other biophysics courses, or permission of the Department.

Physics 75.532W1 (PHY8132)

**Classical Electrodynamics**

Covariant formulation of electrodynamics; Lenard-Wiechert potentials; radiation reaction; plasma physics; dispersion relations.

Prerequisite: Physics 75.437★ and permission of the Department.

Physics 75.561F1 (PHY5966)

**Experimental Techniques of Nuclear and Elementary Particle Physics**

The interaction of radiation and high energy particles with matter; experimental methods of detection and acceleration of particles; use of relativistic kinematics; counting statistics. Prerequisites: Physics 75.437★ and 75.477★ and permission of the Department.

Physics 75.562W1 (PHY5967)

**Physics of Elementary Particles**

Properties of leptons, quarks, and hadrons. The fundamental interactions. Conservation laws; invariance principles and quantum numbers. Resonances observed in hadron-hadron interactions. Three body phase space. Dalitz

plot. Quark model of hadrons, mass formulae. Weak interactions; parity violation, decay of neutral kaons; CP violation; Cabibbo theory. Also offered at the undergraduate level, with different requirements, as Physics 75.462★, for which additional credit is precluded. Prerequisite: Physics 75.477★ and permission of the Department.

Physics 75.564W1 (PHY8164)

**Intermediate Nuclear Physics**

Properties of the deuteron and the neutron-proton force. Nucleon-nucleon forces, isospin and charge independence. Nuclear models. Scattering theory. Interpretation of n-p and p-p scattering experiments. Interaction of nucleons with electrons. Interaction of nuclei with radiation.

Prerequisite: Physics 75.468★ and permission of the Department.

Physics 75.572W1 (PHY8172)

**Relativistic Quantum Mechanics**

Relativistic wave equations. Expansion of S matrix in Feynman perturbation series. Feynman rules. An introduction to quantum electro-dynamics with some second quantization. Gauge theories. May include introduction to Standard Model.

Prerequisite: Physics 75.571 and permission of the Department.

Physics 75.581F1 (PHY5140)

**Methods of Theoretical Physics I**

This course and Physics 75.582 are designed for students who wish to acquire a wide background of mathematical techniques. Topics can include complex variables, evaluation of integrals, approximation techniques, dispersion relations, Padé approximants, boundary value problems, Green's functions, integral equations.

Physics 75.582W1 (PHY5141)

**Methods of Theoretical Physics II**

This course complements 75.581. Topics include group theory, discussion of SU2, SU3, and other symmetry groups. Lorentz group.

Physics 75.590T2 (PHY8290)

**Selected Topics in Physics (M.Sc.)**

A student may, with the permission of the Department, take more than one selected topic, in which case each full course is counted for credit.

Prerequisite: Permission of the Department.

Physics 75.591F1, W1, S1 (PHY8191)

**Selected Topics in Physics (M.Sc.)**

Prerequisite: Permission of the Department.

Physics 75.595F2, W2, S2 (PHY5495)

**Physics in Modern Technology Work Term**

Practical experience for students enrolled in the physics in modern technology stream. To



receive course credit, students must receive satisfactory evaluations for their work term employment. Written and oral reports describing the work term project are required.

**Prerequisites:** Registration in the physics in modern technology stream of the M.Sc. program and permission of the Department.

Physics 75.599F, W, S (PHY7999)

#### **M.Sc. Thesis**

**Prerequisite:** Permission of the Department.

Physics 75.661 (PHY8161)

#### **Particle Physics Phenomenology**

This course covers much of the required knowledge for research in particle physics from both the experimental and theoretical points of view. Topics may include: standard model, parton model, quark model, hadron spectroscopy, and tests of QCD.

**Prerequisite:** Physics 75.562 and permission of the Department.

Physics 75.662 (PHY8162)

#### **Advanced Topics in Particle Physics Phenomenology**

This course will consist of a variety of seminars and short lecture courses, and will cover topics of immediate interest to the research program of the department.

**Prerequisite:** Permission of the Department.

Physics 75.671F1 (PHY8173)

#### **Quantum Electrodynamics**

Relativistic quantum field theory; second quantization of Bose and Fermi fields; reduction and LSZ formalism; perturbation expansion and proof of renormalizability of quantum electrodynamics; calculations of radiative corrections and applications.

**Prerequisites:** Physics 75.511, 75.532, 75.571 and 75.572 and permission of the Department.

Physics 75.690I1 (PHY8490)

#### **Selected Topics in Physics (Ph.D.)**

**Prerequisite:** Permission of the Department.

Physics 75.691F1, W1 (PHY8391)

#### **Selected Topics in Physics (Ph.D.)**

**Prerequisite:** Permission of the Department.

Physics 75.699F, W, S (PHY9999)

#### **Ph.D. Thesis**

**Prerequisite:** Permission of the Department.

**The following courses are offered only at the University of Ottawa:**

Physics 74.501 (PHY5130)

#### **Experimental Characterization Techniques in Materials Science, Physics, Chemistry, and Mineralogy**

Survey of experimental techniques used in materials science, condensed matter physics, solid state chemistry, and mineralogy to char-

acterize materials and solid substances. Diffraction. Spectroscopy. Microscopy and imaging. Other analytic techniques.

**Prerequisite:** Permission of the Department.

Physics 74.503 (PHY5342)

#### **Computer Simulations in Physics**

A course aimed at exploring physics with a computer in situations where analytic methods fail. Numerical solutions of Newton's equations, non-linear dynamics. Molecular dynamics simulations. Monte-Carlo simulations in statistical physics: the Ising model, percolation, crystal growth models. Symbolic computation in classical and quantum physics.

**Prerequisites:** PHY3355 (PHY3755), PHY3370 (PHY3770), and familiarity with FORTRAN, Pascal or C and permission of the Department.

Physics 74.506 (PHY 5362)

#### **Computational Methods in Material Sciences**

Introduction to modern computational techniques used in material science research. Classical molecular dynamics, classical and quantum Monte Carlo methods, plane-wave based electronic band structure calculations, Car-Parrinello quantum molecular dynamics. Applications to condensed matter systems: basic simulation techniques, force-field based methods in the study of thermodynamic and physical properties of solids, first-principles quantum mechanical methods.

**Prerequisite:** Permission of the Department.

Physics 74.512 (PHY5361)

#### **Nonlinear Dynamics in the Natural Sciences**

A multidisciplinary introduction to nonlinear dynamics with emphasis on the techniques of analysis of the dynamic behaviour of physical systems. The course will be organized in two parts. Part I will deal with the basic mathematical concepts underlying nonlinear dynamics, including differential and difference equations, Fourier series and data analysis, stability analysis, Poincaré maps, local bifurcations, routes to chaos and statistical properties of strange attractors. Part II will involve applications of these concepts to specific problems in the natural sciences such as condensed matter physics, molecular physics, fluid mechanics, dissipative structures, evolutionary systems, etc.

**Prerequisite:** Permission of the Department.

Physics 74.541F1 (PHY5100)

#### **Solid State Physics I**

Periodic structures, Lattice waves. Electron states. Static properties of solids. Electron-electron interaction. Dynamics of electrons. Transport properties. Optical properties.

**Prerequisite:** Permission of the Department.

Physics 74.542 (PHY5110)

**Solid State Physics II**

Elements of group theory. Band structure, tight binding and other approximations, Hartree-Fock theory. Measuring the Fermi surface. Boltzmann equation and semiconductors. Diamagnetism, paramagnetism and magnetic ordering. Superconductivity.

Prerequisite: Permission of the Department.

Physics 74.543 (PHY5151)

**Type I and II Superconductors**

Flux flow and flux cutting phenomena. Clem general critical state model. Flux quantization, Abrikosov vortex model and Ginzburg-Landau theory. Superconducting tunnelling junctions (Giaever and Josephson types).

Prerequisite: PHY4370 and permission of the Department.

Physics 74.544 (PHY6371)

**Topics in Mössbauer Spectroscopy**

Experimental techniques used to measure Mössbauer spectra. Physics of the Mössbauer effect: recoilless emission/absorption, anisotropic Debye-Waller factors, second order Doppler shifts, etc. Mössbauer lineshape theory with static and dynamic hyperfine interactions. Distributions of static hyperfine parameters. Physics of the hyperfine parameters: origin of the hyperfine field, calculations of electric field gradients, etc. Applications of Mössbauer spectroscopy to various areas of solid state physics and materials science.

Prerequisite: Permission of the Department.

Physics 74.547 (PHY5380)

**Semiconductor Physics I**

Brillouin zones and band theory. E-k diagram, effective mass tensors, etc. Electrical properties of semiconductors. Conduction, hall effect, magneto-resistance. Scattering processes. Multivalley models and non-parabolic bands.

Prerequisite: PHY4380 and permission of the Department.

Physics 74.548 (PHY5381/PHY5781)

**Semiconductor Physics II: Optical Properties**

Optical constants and dispersion theory. Optical absorption, reflection and band structure. Absorption at band edge and excitons. Lattice, defect and free carrier absorption, Magneto-optics. Photo-electronic properties, luminescence, detector theory. Experimental methods.

Prerequisite: PHY4380 and permission of the Department.

Physics 74.549 (PHY5951)

**Low Temperature Physics II**

Helium 3 and Helium 4 cryostats. Dilution refrigerators. Theory and techniques of adiabatic demagnetization. Thermometry at low

temperatures. Problems of thermal equilibrium and of thermal isolation. Properties of matter at very low temperature.

Prerequisite: PHY4355 and permission of the Department.

Physics 74.551 (PHY5125)

**Charged Particle Dynamics**

A course on the acceleration, transport and focusing of charged particles in vacuum using electric magnetic fields. Beam optics. Phase space of an assembly of particles. Applications to experimental systems.

Prerequisite: Permission of the Department.

Physics 74.554 (PHY5387)

**Physics of Materials**

Microscopic characteristics related to the physical properties of materials. Materials families: metals and alloys, ceramics, polymers and plastics, composites, layered materials, ionic solids, molecular solids, etc. Specific materials groups. Equilibrium phase diagrams and their relation to microstructure and kinetics. Experimental methods of characterization. Interactions and reactions.

Prerequisite: PHY 4382 or equivalent. Cannot be combined with PHY4387.

Physics 74.555 (PHY5355)

**Statistical Mechanics**

Ensemble Theory. Interacting classical and quantum systems. Phase transitions and critical phenomena. Fluctuations and linear response theory. Kinetic equations.

Prerequisites: PHY4370 and PHY3355 and permission of the Department.

Physics 74.556 (PHY5742)

**Simulations Numériques en Physique**

Un cours ayant pour but d'étudier la physique à l'aide d'un ordinateur dans des situations où les méthodes analytiques sont inadéquates. Solutions numériques des équations de Newton. Dynamique non-linéaire. Simulations de dynamique moléculaire. Simulations Monte-Carlo en physique statistique: modèle d'Ising, percolation, croissance cristalline. Calcul symbolique en physique classique et quantique. Ce cours exclut les crédits de 75.502 (PHY5344). Prélabales: PHY3755 (PHY3355), PHY3770 (PHY3770) et connaissance d'un des langages FORTRAN, Pascal ou C.

Physics 74.557 (PHY5922)

**Advanced Magnetism**

Study of some of the experimental and theoretical aspects of magnetic phenomena found in ferro-, ferri-, antiferro-magnetic and spin glass materials. Topics of current interest in magnetism.

Prerequisite: PHY4385 and permission of the Department.

Physics 74.558 (PHY5320)

**Introduction to the Physics of Macromolecules**

The chemistry of macromolecules and polymers; random walks and the static properties of polymers; experimental methods; the Rouse model and single chain dynamics; polymer melts and viscoelasticity; the Flory-Huggins theory; the reptation theory; computer simulation algorithms; biopolymers and copolymers.

Prerequisite: Permission of the Department.

Physics 74.559 (PHY5347)

**Physics, Chemistry and Characterization of Mineral Systems**

The materials science of mineral systems such as the network and layered silicates. In-depth study of the relations between mineralogically relevant variables such as: atomic structure, crystal chemistry, site populations, valence state populations, crystallization conditions, etc. Interpretation and basic understanding of key characterization tools such as: microprobe analysis, Mössbauer spectroscopy, X-ray diffraction and optical spectroscopy.

Prerequisite: Permission of the Department.

Physics 74.563 (PHY5310)

**Ion Collisions in Solids**

Energy loss of energetic particles in passing through solids. Stopping cross sections. The influence of crystal lattice on nuclear stopping. Crystal lattice effects at high energies. Channelling and blocking. The collision cascade. Charge states of fast ions in solids from thin foil and X-ray measurements.

Physics 74.573 (PHY6170)

**Advanced Quantum Mechanics II**

Systems of identical particles and many-body theory. Lattice and impurity scattering. Quantum processes in a magnetic field. Radiative and non-radiative transitions. Introduction to relativistic quantum mechanics.

Prerequisite: PHY5170 and permission of the Department.

Physics 74.646 (PHY6382)

**Physics of Semiconductor Superlattices**

Fundamental physics of two-dimensional quantized semiconductor structures. Electronic and optical properties of superlattices and quantum wells. Optical and electronic applications. This course is intended for students registered for the Ph.D. in semiconductor physics research.

Prerequisite: Advanced undergraduate or graduate course in solid state physics and permission of the Department.

Physics 74.647 (PHY6782)

**Physique des super-réseaux à semiconducteurs**

Physique fondamentale des structures quantiques bi-dimensionnelles à semiconducteurs. Propriétés électroniques et optiques des super-réseaux et puits quantiques. Applications à l'électronique et à l'optique. Ce cours est destiné aux étudiants et aux étudiantes inscrits au doctorat en physique des semiconducteurs.

Préalable: Cours sénior ou diplômé en physique de l'état solide.



## Political Economy

Loeb Building A818  
Telephone: 520-7414  
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### The Institute

**Director of the Institute,** Wallace Clement

The Institute of Political Economy, established in 1989, developed out of the Graduate Summer School of Political Economy, which was formed in 1983. The summer school was built on the strong tradition of interdisciplinary studies at Carleton, and on the interests of numerous faculty at Carleton involved in political economy. Distinguished international scholars have been attracted to teach in the summer school. Through the Institute, these distinguished visitors will now be in residence during the normal academic year, in addition to the summer program.

The Institute offers a program of study and research leading to the degree of Master of Arts in Political Economy, the only program of its kind in Canada. Its interdisciplinary program is designed to offer students both an exposure to the core concepts of political economy and an opportunity to develop individual areas of research concentration.

The program focuses on investigating the relationship between the economy and politics as they affect the social and cultural life of societies, and secondly, focuses on the historical processes whereby social change is located in the interaction of the economic, political, cultural, and ideological moments of social life.

Carleton University has developed a strong tradition in political economy. Faculty members from most of the social sciences and history participate regularly in the Institute. The program's curriculum includes courses with a political economy orientation that are offered by other departments, schools, and institutes. The Master of Arts in Political Economy is an opportunity for students to study political economy from the perspective of different disciplines within a single program.

### Qualifying-Year Program

Applicants who have a general (3 year) bachelor's degree in one of the disciplines represented in the program may be admitted to a qualifying-year program designed to raise their status to that of honours graduates. Students are expected to achieve at least high honours in qualifying-year courses in order to be con-

sidered for admission to the master's program. To be eligible for admission to a qualifying year, normally a student must previously have successfully completed at least four courses in one of the social sciences.

Refer to the General Regulations section of the Calendar for details of the regulations governing qualifying year.

### Master of Arts

#### Admission Requirements

The normal requirement for admission to the master's program is B.A. (Honours), with at least high honours standing, in one of the disciplines represented in the Institute. Prospective applicants without such qualifications may be considered for admission if they have both a strong academic record and relevant work experience. Such students normally are asked to complete a qualifying year of study with at least high honours standing before proceeding to the master's program.

#### Program Requirements

The Master of Arts in Political Economy is a 5.0 credit program, one of which may be at the 400- (honours undergraduate) level. Each candidate, in consultation with the Institute, must select and follow one of two optional patterns:

- \* 3.0 credits, a thesis equivalent to 2.0 credits, and an oral examination of the thesis

- \* 4.0 credits, a research essay equivalent to 1.0 credit, and an oral examination of the research essay

Whichever pattern is selected, all students in the Institute are required to take Political Economy 44.500 and 44.501, two 0.5 credit seminars offered by the Institute.

As well, students must select at least 0.5 credits from the following: Sociology 53.525, or Political Science 47.509, or International Affairs 46.588, or Political Science 47.588, or approved equivalents of these courses. Registration in these courses is contingent upon the completion of all prerequisites or, in exceptional cases, obtaining the permission of the relevant department or school. The base course pattern annually available to students would normally be:

#### *Fall Term*

- \* Political Economy 44.500

- \* One of: Sociology 53.525 or Political Science 47.509 or International Affairs 46.588, or Political Science 47.588

\* Political Economy 44.551 (0.5 credit course taught by the visiting professor of the Institute of Political Economy)

*Winter Term*

\* Political Economy 44.501

\* One of: Sociology 53.525, or Political Science 47.509 or International Affairs 46.588, or Political Science 47.588

\* Political Economy 44.552 (0.5 credit course taught by the visiting professor of the Institute of Political Economy)

*Summer Term*

\* Political Economy 44.551 and Political Economy 44.552 (two 0.5 credit courses taught by the visiting professor of the Institute of Political Economy and two 0.5 credit courses contributed by participating departments).

## Academic Standing

All master's candidates must maintain *B* standing or better (GPA of 8.0). A candidate may, with the recommendation of the Institute and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of *C+* in 1.0 credit.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

The Institute's courses will not normally be open to undergraduate students.

Political Economy 44.500F1,W1,S1

### Theories of Political Economy

A survey of the evolution of the core concepts and ideas proposed by both the founders and modern practitioners of the various approaches to political economy. Particular attention will be paid to contemporary theorists as well as classical theorists such as Smith, Ricardo, Marx, Mill, Schumpeter, Keynes, Veblen, and Innis.

Political Economy 44.501F1,W1,S1

### The Methodology of Political Economy

An examination of the methods, procedures, and rules for developing theory and guiding inquiry in political economy research, including topics such as logic of inquiry,

conceptualization, research design, dialectics, level of analysis, comparison, evidence and statistics.

Political Economy 44.551F1,W1,S1

### Selected Problems in Political Economy I

(Also listed as Sociology 53.554 and Political Science 47.551)

Political Economy 44.552F1,W1,S1

### Selected Problems in Political Economy II

(Also listed as Sociology 53.555 and Political Science 47.552)

Political Economy 44.590F1,W1,S1

### Tutorial in Political Economy

A course of directed readings on selected aspects of political economy, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.

Prerequisite: Permission of the Director.

Political Economy 44.598F2,W2,S2

### Research Essay

Directly linked to the student's course work, the research essay must be interdisciplinary in approach.

Political Economy 44.599F4,W4,S4

### M.A. Thesis

The thesis is an alternative to the research essay. It must also be interdisciplinary in approach, and requires greater substance and originality than the Research Essay. Normally, a student's thesis committee will be composed of members from more than one discipline.

## Selection of Courses

In addition to the graduate courses offered by, or associated with, the Institute, the courses listed below are of relevance to students of political economy and would, with the prior approval of the Institute, be used to design a coherent and internally complementary set of courses to fulfill degree requirements. The list is not exclusive and is subject to change. Moreover, students may select 1.0 credit in political economy that is offered at the 400-level.

Note: Students should be aware that the number of spaces in graduate courses offered by other departments may be limited, and that registration may be conditional upon obtaining the prior approval of the department concerned. It is the student's responsibility to ensure that permission is obtained from the appropriate department prior to registering in any of the following courses.

The Institute expects to attract high quality graduate students who will be likely to con-

## Political Economy

tinue to a second post-graduate degree. Given that a Ph.D. program in political economy does not exist, master's students will be directed to consult with the department where they might wish to pursue doctoral studies so that they may select courses that will prepare them for this next stage.

### *Business*

42.530, 42.531

### *Canadian Studies*

12.510, 12.520, 12.530

### *Economics*

43.511, 43.521, 43.533, 43.538, 43.541, 43.542, 43.543, 43.544, 43.550, 43.554, 43.555, 43.586, 43.587

### *Geography*

45.427

### *Urban Development and Analysis*

45.520, 45.540, 45.541, 45.544

### *History*

24.421 Science and Technology in the Canadian Experience

24.422 The Maritimes in Transition, 1870s to 1920s

24.431 Canada from Confederation to the Great War

24.433 Selected Problems in Canadian Business History 1850-1980

24.437 Canada from War to War

24.439 Modern Canada since 1939

24.459 Selected Problems in Nineteenth- and Twentieth-Century British Social History

24.459 Selected Problems in the History of Women and the Family: from the Industrial Revolution

24.471 Selected Problems in International Economic History

24.525, 24.530, 24.532, 24.534, 24.536, 24.537, 24.558, 24.559

### *International Affairs*

46.561, 46.564, 46.567, 46.580, 46.582

### *Law*

51.401 ★ Law, Family and Gender

51.402 ★ Feminist Theories of Law

51.403 ★ Historical Perspectives on Law, Economy and Society

51.502, 51.503, 51.504, 51.505, 51.506, 51.507, 51.520, 51.532

### *Political Science*

47.400 Topics in Canadian Government and Politics

47.409 ★ Quebec Politics

47.412 ★ Politics of Western Liberal Democracies

47.413 ★ The State in Advanced Capitalist Societies

47.414 ★ Theory and Practice in Third World Development

47.415 ★ Selected Problems in Third World Development

47.431 ★ Marxist Thought

47.432 ★ Contemporary Marxism

47.441 ★ Business-Government Relations in Canada

47.463 ★ Analysis of International Political Economy

47.464 ★ Selected Problems in International Political Economy

47.503, 47.508, 47.511, 47.517, 47.522, 47.551, 47.552

### *Public Administration*

50.502, 50.517, 50.519, 50.520, 50.536, 50.537, 50.562, 50.567, 50.568, 50.570, 50.572, 50.573

### *Sociology and Anthropology*

53.500, 53.502, 53.507, 53.509, 53.511, 53.519, 53.522, 53.525, 53.527, 53.529, 53.530, 53.531, 53.532, 53.538, 53.540, 53.544, 53.545, 53.554, 53.555, 53.567, 53.568, 53.584



## Political Science

Loeb Building B640  
 Telephone: 520-2764  
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### The Department

**Chair of the Department,** Glen Williams

**Assistant Chair,** L. Macdonald

**Departmental Supervisor of Graduate Studies,** P. Dutkiewicz

The Department offers programs leading to the M.A. and Ph.D. degrees. Graduate study and research may be undertaken in the fields of political theory, Canadian government and politics, comparative government and politics, international relations, and public administration and policy analysis. Within these fields, students may select more specialized areas, such as classical, medieval, and modern, or analytic and empirical theory; comparative government and politics of a particular area or group of countries where the Department has developed particular strength.

In the Department and the self-standing schools and institutes, Carleton University houses one of the three largest concentrations in Canada of well-known political science professionals. In this configuration, the Department is unique in offering the full range of fields that make up modern political science, and is thus well placed to develop critical and analytical skills in its degree candidates, as the range of perspectives, priorities, and methodologies in contemporary political theory and political studies in general are brought into close relation with one another.

The Department is committed to the view that the goal of studying politics is to continue and further the search for the meaning and the morality of public life (community) by historical, critical, empirical, and analytical means. A community's politics and its public policy describe the extent of political community that is aspired to, and which can feasibly be accomplished given the context of power relations in the international and domestic institutional and economic conjunctures. The Department exists to continue the discussions that run through the history of the study of politics about what is good, and how to maintain the autonomy of the sphere of the public and the political in the face of multiple challenges, which now include citizen apathy and economic forces that escape states. Students emerge with minds trained to

identify, weigh, and sift ideals and evidence, using the full range of methodologies, and also with a grounding in the politics of areas and institutional configurations. They are also equipped for one of the most important roles in human life: that of citizen.

### Qualifying-Year Program

Applicants who have a general (3-year) B.A. in Political Science, with second-class standing, may be considered for admission to a qualifying-year program. Candidates who complete the qualifying year with high honours standing may be considered for admission to the master's program the following year.

Refer to the General Regulations section of this Calendar for details of the regulations governing the qualifying year.

### Master of Arts

#### Admission Requirements

The normal requirement for admission to the master's program is B.A.(Honours) (or the equivalent) in Political Science, with at least high honours standing.

Honours graduates in fields other than political science will be considered on the basis of their academic background and standing, and will be judged on a case-by-case basis. Those with only minor deficiencies may be required to take certain specified courses, while others whose degrees are less closely related to political science may be required to register in the qualifying year, at the discretion of the Department. Graduates of three-year programs in political science will be required either to complete the fourth year of an honours degree and reapply, or register in the qualifying year of the M.A. (see above), depending on work completed to date and academic standing.

#### Program Requirements

All master's candidates will fulfill a 5.0 credit program requiring departmental approval. No more than 1.0 credit may be taken at the 400-level. It is anticipated that candidates will enter with both political theory and research methods in their backgrounds. In cases where this is not so, candidates will, with the advice of the Department, select suitable courses as part of their programs.

All candidates, in consultation with the Department, will pursue their degree either by course work only or by undertaking an independent research project. The independent research project can be fulfilled in one of

two ways: a 1.0 credit research paper on a topic related to at least one of the courses taken, that may represent a significant development of one or more papers submitted in fulfillment of course requirements; or a 2.0 credit thesis.

Details of defences for the above M.A. options are outlined in the section on defences.

Students who choose to specialize in Canadian government and politics must demonstrate a reading knowledge of French, except where a degree of proficiency in another language makes more sense in relation to the student's program of studies.

Students whose mother tongue is other than English and who do not intend to specialize in Canadian politics, or students whose research interests require another language or another research skill such as methods, may obtain permission from the Department to substitute another language or a research skill for French. Departmental language tests are administered twice a year.

The language requirement may also be satisfied by passing an approved language course with a grade of B- or better.

### Course Requirements

All master's candidates are required to take an approved methods course. Students who have not already taken a course in research design and methods at the undergraduate level may be required, depending on the course pattern chosen, to take Political Science 47.570. When appropriate and related significantly to the program of study, another methods course, such as Political Science 47.534, 47.571, 47.572, or 47.573, may be substituted.

Candidates will follow one of three program patterns:

- \* 5.0 credits in approved courses
- \* Research Essay (1.0 credit) and 4.0 credits in courses
- \* Thesis (2.0 credits) and 3.0 credits in courses

Students following one of the M.A. study themes will follow one of two program patterns:

- \* 5.0 credits in approved courses
- \* Research Essay (1.0 credit) and 4.0 credits in courses

All students will receive faculty assistance in building their programs. General M.A. students will compose their own programs with the assistance of their faculty adviser and the graduate supervisor. Students pursuing a the-

matic option will choose a number of courses from among those listed annually, posted by June each year. Students following themes of study will receive approval for their plans of study from the faculty coordinator for that theme and the graduate supervisor.

Master's students are asked to note that the Department has considerable strength in Canadian government and politics. Students opting to concentrate on Canada will be given assistance to develop their own program of study in this area.

### Study Themes

The Department draws to the attention of students the possibility of pursuing planned themes or special topics of study that draw systematically from the department's range of courses and expertise across two or more of the traditional fields of political science, and also opens the possibility of pursuing, depending upon prerequisites and with the permission of the academic units concerned, planned streams of course work across other departments, schools, and institutes of the University.

Themes include:

- \* Public affairs and policy analysis, with emphasis on quantitative analysis of public opinion, media impacts on policy, and on policy outcomes
- \* A political theory concentration that focuses on contemporary problems of modernity including the challenge that technology presents to the state
- \* North American community studies, with an emphasis on political institutions and how trade instruments affect domestic and regional politics
- \* European politics, which treats political integration and transitions in both western and eastern Europe
- \* Global politics and society
- \* Critical and analytical approaches to development in regard to selected geographical areas
- \* Government and institutions, at whose centre is an exploration of the role of the state and the importance of institutional provisions

Students pursuing a thematic option are required to meet the general program requirements for the M.A. degree. The course requirements that characterize each theme of study are listed below following the general theme description. The balance between core and optional courses differs across themes. In

all cases where courses are taken outside the Department, students must have the prerequisites or obtain permission of the instructor of the course in question.

*Public Affairs and Policy Analysis*

This theme of study focuses on theoretical and practical analysis of the policy process, including the design, management, communication, and analysis of all aspects of policy, with particular emphasis on quantitative analysis of public opinion, media impacts on policy, and policy outcomes.

Students must normally complete a total of 5.0 credits consisting of:

- \* Approved methods course(s)
- \* Political Science 47.647
- \* Political Science 47.648
- \* Research Essay (1.0 credit) on a topic appropriate to the theme; and/or
- \* Approved course options

*Political Theory: Modernity, Technology, and the Common Good*

This theme explores ethical and analytical concepts for the evaluation of contemporary political practice, including legitimacy, civic virtue, and human rights. Its central topics include the critique of modernity; global technology; the communitarian-liberalism debate; alternative understandings of the common good; and the competing claims of charity and justice. Its approaches include hermeneutics, phenomenology, postmodernism, critical theory, democratic theory, and political culture and myth.

Students must normally complete a total of 5.0 credits consisting of:

- \* Approved methods course(s)
- \* Political Science 47.630 and 47.631
- \* At least 1.0 credit from a list of courses approved annually for the core
- \* Research Essay (1.0 credit) on a topic appropriate to the theme; and/or
- \* Approved course options

*North American Government and Community Studies*

This theme of study focuses on the politics and the integrative/disintegrative forces operating among the countries of North America: the United States, Canada, and Mexico. Students will explore issues relevant to the political association of these states in the North

American political community from a variety of perspectives, including structures, political economy, the domestic politics of the play-

ers, and the international relations within the zone.

Students must normally complete a total of 5.0 credits consisting of:

- \* Approved methods course(s)
- \* At least 1.0 credit from a list of courses approved annually for the core
- \* Research Essay (1.0 credit) on a topic appropriate to the theme; and/or
- \* Approved course options

*European Politics*

The theme focuses on the end-of-century transitions of European politics, encompassing political integration through the European Union and the transition from communism in Eastern Europe, Central Europe, and Russia.

These changes have called into question conventional thinking about market reform, democratization, and the role of the state. Because these shifts and transformations have created an environment in which European political issues have become both more continental in scope and more comparable, students opting for this scheme can pursue a course of study encompassing both Western and Eastern Europe.

Students must normally complete a total of 5.0 credits consisting of:

- \* Approved methods course(s)
- \* At least 1.5 credits from a list of courses approved annually for the core
- \* Research Essay (1.0 credit) on a topic appropriate to the theme; and/or
- \* Approved course options

*Development Politics*

This theme features topical, critical, and analytical approaches to development. Students will explore the political economy of development and underdevelopment, democratization and the elaboration of "civil society", the politics of aid-giving and receiving, and the role of non-governmental organizations. Approved options include courses that focus on regions, including Africa, Latin America, and the post-communist countries, as well as Canada.

Students must normally complete a total of 5.0 credits consisting of:

- \* Approved methods course(a)
- \* At least 1.5 credits from a list of courses approved annually for the core



## Political Science

\* Research Essay (1.0 credit) on a topic appropriate to the theme;

and/or

\* Approved course options in area or regional studies

### *Global Politics and Society*

This theme focuses on two related themes: the politics of global society, and Canada and the world. Students will explore the ways in which the process of globalization, conceived as the compression of the world and the intensification of consciousness of the world as a whole, accelerated by the political and economic collapse of the communist bloc and the integration of its successor states into the world economy, has altered the international economic and political orders. The second theme, Canada and the world, is designed to enable students to explore the implications of this globalization process for the future of Canada.

Students must normally complete a total of 5.0 credits consisting of:

\* Approved methods course(s)

\* At least 1.5 credits from a list of courses approved annually for the core

\* Research Essay (1.0 credit) on a topic appropriate to the theme;

and/or

\* Approved course options

### *Government and Institutions*

The "government" theme of study is concentrated upon state institutions, taking up recent debates about the effectiveness of various kinds of regimes and institutional and rule structures, the role that such structures play in promoting or resisting change, and the changes in the reach and autonomy of politics and the state itself amid fiscal crises and other challenges. Within the theme, students can choose to centre their options on Canada, or they may pursue comparative (area, regional) studies.

Students must normally complete a total of 5.0 credits consisting of:

\* Approved methods course(s)

\* At least 1.0 credit on state institutions, governance, and the issue of how much room is left for politics in different economic environments, from among courses approved annually for the core

\* At least 1.0 credit drawn from a list of courses approved annually whose emphasis is on re-

gime types and the configuration of representative institutions, including the place of bureaucracy, and organizations

\* Research Essay (1.0 credit) on a topic appropriate to the theme;

and/or

\* Approved course options

## Defences

In the case of the student choosing a research essay, that essay will be evaluated by two of the Department's faculty members including the supervisor and a second reader, and a letter grade will be assigned. An oral defence of the essay is not required but may be requested by the supervisor or second reader.

In the case of the student choosing a thesis, the thesis will be evaluated by three people: the student's thesis supervisor from the Department, a second reader from the Department, and an external third reader who is generally from another Carleton Department but may sometimes come from outside the University. A thesis must be defended orally before the three evaluators. No letter grade is assigned, but notations of *Pass with Distinction*, *Satisfactory*, and *Unsatisfactory* are assigned.

## Academic Standing

All master's candidates must obtain a B standing or better (GPA 8.0). One grade of C+ may be allowed.

## Cooperative Placements

Cooperative placements may be available to persons eligible to work in Canada who are full-time students. These placements locate students for at least one term in government departments or non-governmental organizations, and integrate the theoretical and practical aspects of Political Science. Placements are not for academic credit; however, with the approval of the Supervisor of Graduate Studies, a placement may be combined with Political Science 47.590 or 47.591.

## Doctor of Philosophy

The Ph.D. program in political science normally will be undertaken on a full-time basis. However, in cases of exceptional merit, the Department will accept a few candidates for the degree on a part-time basis.

## Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree (or its equivalent) in political science with high hon-

ours standing or better. Applicants should note, however, that meeting the admission requirement does not guarantee admission to the program. Review of the department's competitive selection process indicates that students with a GPA below 10.0 (4) in the master's program are generally not recommended for admission to the doctoral program. Students applying on the basis of a master's degree from other disciplines will be considered on a case-by-case basis, and may be required to take additional courses as part of the program.

### Program Requirements

The normal program requirements for Ph.D. candidates are outlined in the General Regulations section of this Calendar.

It is anticipated that Ph.D. candidates will enter with a background in political theory at the undergraduate level, regardless of their desired field of specialization. Those who do not will be treated as special cases and will have their programs arranged accordingly. If statistical proficiency is needed for the preparation of the thesis, students will also be expected to take a course in research methods. Candidates are also expected to demonstrate proficiency in a second language or in research methods. All candidates will complete 47.696.

The program requirements (10.0 credits unless additional course work is required) for Ph.D. candidates in Political Science are the following:

- \* At least 1.0 credit at the graduate level in each of the candidate's two major fields of study; a GPA of 9.0 or better must be obtained in these courses for students to be allowed to proceed to the comprehensive examinations.

- \* Satisfactory completion of Political Science 47.690 (1.0 credit), preparation for a written comprehensive examination covering the two major fields. The grade to be awarded will be that obtained on the field examinations, normally written in two parts with one week between the parts, on two occasions each year, April and August.

- \* Proficiency in a research skill, as outlined under research skill requirement

- \* At least 1.0 credit will normally be taken during the second year of the program in fields allied to the major topics of the thesis. This credit will normally be fulfilled through regular course work rather than tutorials.

- \* Successful completion of Political Science 47.696 (1.0 credit)

- \* A public defence, in English, of a written thesis proposal

- \* A 5.0 credit thesis, written in English or French, which will be defended in English at an oral examination.

Full-time students are required to complete the comprehensive examinations within 12 months of entering the program, and must normally complete the public defence of the thesis proposal, preceded by its formal acceptance by the supervisory committee, within 24 months of entering the doctoral program.

Ph.D. candidates will each be assigned a faculty member to advise them on their studies. Students' programs, including the choice of supervisor and the thesis committee, must be approved by the Department. The thesis supervisor will normally be chosen from among faculty members in the Department of Political Science. Upon approval of the thesis supervisor and the Department, committee members may be chosen from elsewhere within the University.

### Research Skill Requirement

Ph.D. candidates must demonstrate the ability to use a research skill appropriate to their program. The research skill requirement will normally be satisfied before the defence of the thesis proposal, and will take one of the following forms:

- \* An ability to read and translate French or another language appropriate to their course of study; or the ability to speak a language other than English sufficient to conduct interviews in that language

- \* Credit work in an approved political science methods course, workshop, or colloquium, equivalent to 1.0 credit; or any two of the following courses (or an approved alternative): Political Science 47.570, 47.571, 47.572, and 47.573.

### Comprehensive Examinations

All Ph.D. candidates must successfully complete a written comprehensive examination covering their two major fields. The examination is in the form of two examination papers normally written one week apart. At the discretion of the Department, candidates may be required to take an oral examination following the written examination.

The fields of study for the Ph.D. comprehensive examination are to be chosen from the following list:

*Political Theory*

A general knowledge of the main outlines

and significant themes and problems of political philosophy and thought.

*Canadian Government and Politics*

A general knowledge of Canadian political ideas, institutions, and processes.

*Comparative Government and Politics*

A general knowledge of the theories and methodology of comparative politics.

*International Relations*

A general knowledge of international theory, international organization, and the development of the field of international relations.

*Public Administration and Policy Analysis*

A general knowledge of theories of bureaucracy, organization, and public administration; and theory, practice, and methods of analysis in public affairs and public policy within and outside Canada.

## Thesis Proposal

All students must publicly defend a thesis proposal after completing their comprehensive examinations. Full-time students must complete this requirement within the first two years of registration in the program. Details on this program requirement are provided in *Departmental Guidelines for the Graduate Program*.

## Selection of Courses

Within the scope of the regulations, the following undergraduate courses (fully described in the *Undergraduate Calendar*) may be taken by graduate students.

Please note that not all of these courses are offered every year. Students should consult the timetable published each year in early June.

*Political Science*

47.400 Topics in Canadian Government and Politics

47.402 Policy Seminar: Problems of Northern Development

47.403 Politics and the Media

47.405 Stability, Justice and Federalism

47.406 Legislative Process in Canada

47.407 The Politics of Law Enforcement in Canada

47.408 National Security and Intelligence in the Modern State

47.409 Quebec Politics

47.410 Canadian and Comparative Local Government and Politics

47.411 French-English Relations

47.412 Politics of Western Liberal Democracies

47.413 The State in Advanced Capitalist Societies

47.414 Theory and Practice in Third World Development

47.415 Selected Problems in Third World Development

47.416 Labour and the Canadian State

47.417 Political Participation in Canada

47.418 Canadian Provincial Government and Politics

47.419 The Politics of the Canadian Charter of Rights and Freedoms

47.420 Policy Making in the United States

47.421 Politics of Influence in the United States

47.422 Comparative Constitutional Politics

47.431 Marxist Thought

47.432 Contemporary Marxism

47.435 Contemporary Political Theory

47.436 Concepts of Political Community I

47.437 Concepts of Political Community II

47.441 Business-Government Relations in Canada

47.448 Public Organizations: Theory and Practice

47.450 Feminist Political Analysis in Comparative Perspective

47.455 Transitions to Democracy

47.460 Analysis of International Politics

47.461 Foreign Policies of Soviet Successor States

47.463 Analysis of International Political Economy

47.464 Selected Problems in International Political Economy

47.466 American Foreign Policy

47.467 International Politics of North America

47.482 International Politics of Africa

47.483 Foreign Policies of Major East Asian Powers

47.484 International Relations of South and South-East Asia

Students are encouraged to look for courses within Carleton in the Departments of Economics, Geography, History, Law, Philosophy,



and Sociology and Anthropology; the Schools of Business, Journalism and Communication, Public Administration, and the Norman Paterson School of International Affairs; and in the Institutes of European and Russian Studies, and Political Economy. They are equally strongly encouraged to look for courses in the Departments of Political Science and Philosophy at the University of Ottawa.

All courses selected will be subject to the approval of the Department, on grounds of appropriateness to the program of study and the avoidance of excessive overlap between courses.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Enrolment in graduate courses requires the permission of the Department, through the supervisor of graduate studies.

### Political Science 47.500F1 or W1 Canadian Political Institutions

A seminar on selected topics on institutions of Canadian government at the federal level. Also offered at the undergraduate level, with different requirements, as Political Science 47.400, for which additional credit is precluded.

### Political 47.502F1 or W1 Political Law: Principles

An examination of the legal framework of the state, and the various types of instruments of government. It treats the way law makes its impact upon decision-making, with a particular focus on the influence of law on policy, administrative action, and political life.

### Political Science 47.503F1 or W1 Political Parties in Canada

A seminar on political parties and party systems in Canadian federal politics, including an examination of patterns of historical development, party organization and finance, relationships with social movements, and the impact of Canadian federalism.

### Political Science 47.506F1 or W1 Topics in Canadian Government and Politics

Depending on student demand and faculty

interest, a seminar will be offered on the challenges offered by citizens, politicians and governments in Canada.

### Political Science 47.507F1 or W1 Topics in Canadian Politics and Government in Comparative Perspective

Depending on student demand and faculty interest, a seminar will be offered on topics in Canadian politics and government within a comparative perspective, the various countries being considered chosen on the basis of the issue at hand.

### Political Science 47.508F1 or W1 The Politics of Energy and the Environment

A research seminar focusing upon the substantive issues, the policy structures and processes, and current Canadian governmental response in the area of energy policy and environmental quality management.

### Political Science 47.509F1 or W1 Canadian Political Economy

A seminar on political economy as a traditional and contemporary approach to the study of Canadian politics and the Canadian state. Canada's economic development, social relations (including gender and race relations), and position in the international political economy is explored.

### Political Science 47.510F1 or W1 Indigenous Politics of North America

Examines issues of governance regarding the original peoples of Canada, Mexico and the United States before and since the European invasion, including: movement for restoration of cultural, socio-economic, political, land and self-government rights. Also offered at the undergraduate level, with different requirements, as Political Science 47.426, for which additional credit is precluded.

### Political Science 47.511F1 or W1 Canadian Federalism

A study of the evolution and contemporary operation of the Canadian federal system, noting particularly the specific social, political, economic, and structural features which underlie its operational performance, its resilience in crisis, and its potential for adaptation.

### Political Science 47.514F1 or W1 The Transition from Communism

An in-depth investigation of the problems of transition in post-communist societies.

### Political Science 47.515F1 or W1 Post-Communist Politics in East Central Europe

A comparative examination of the emergence of post-communist political systems in East Central Europe.

## Political Science

Political Science 47.516F1 or W1

### **Selected Problems in the Politics of Soviet Successor States**

A seminar on selected problems of nation-building in Russia, Ukraine, and other Soviet successor states.

Political Science 47.517F1 or W1

### **Globalization, Adjustment and Democracy in Africa**

This course will explore the nature of global pressures in Africa as states go through a "second wind" of political and economic change. Also offered at the undergraduate level, with different requirements, as Political Science 47.427, for which additional credit is precluded.

Political Science 47.518F1 or W1

### **State, Revolution and Reform**

The dynamics of political change and economic growth in non-Western states, emphasizing challenges to dominant patterns of policy-making with a view of exploring alternate modes of modernity.

Political Science 47.519F1 or W1

### **Comparative Public Policy**

A review of approaches to the study of policy, of the impact of political factors on policy, and of the substance of policy choices in such domestic fields as communications, social security, health, industrial and rural development policies in selected countries.

Political Science 47.520F1 or W1

### **Nationalism**

A seminar on the historical and comparative study of nationalism, with emphasis on its role in the promotion of political change.

Political Science 47.521F1 or W1

### **Politics in Plural Societies**

A seminar on politics in multicultural societies and multi-national states, including settler and post-colonial societies. Topics may include: conflict relating to race, religion, language, regionalism, intra-state nationalism, multicultural policies and theories of pluralism.

Political Science 47.522F1 or W1

### **Politics of Third World Development**

A seminar examining the politics of development and underdevelopment in the Third World. Topics covered include theory, selected issues, and case studies from Africa, Asia, and Latin America.

Political Science 47.523F1 or W1

### **Southern Africa in the Post-Apartheid Era**

This course will explore the pathology of apartheid, the reasons for its end, and prospects for democratization and development

in southern Africa in the era of globalization. Also offered at the undergraduate level, with different requirements, as Political Science 47.423, for which additional credit is precluded.

Political Science 47.524F1 or W1

### **Elections**

The conduct and meaning of elections in contemporary states. Attention to the connection of elections to concepts of representation, policy mandates, and political parties, and to electoral systems and referenda. Also offered at the undergraduate level, with different requirements, as Political Science 47.424★, for which additional credit is precluded.

Political Science 47.525F1 or W1

### **Problems in American Government I**

A research seminar on topics such as the distribution of power, decision-making processes, the impact of technology, strains in inter-governmental relations, civil-military relations, governmental news management and secrecy; executive accountability, and impediments to reform of Congress and the presidency.

Political Science 47.526F1 or W1

### **Problems in American Government II**

A research seminar on topics such as political violence and social change, the roles of mass media, business élite roles, political corruption, civil rights and minority politics, and the urban crisis.

Political Science 47.531F1 or W1

### **Modern Political Culture and Ideology**

This seminar explores certain connections among image, symbol, myth, language, and politics. Topics include the expressive and designative conceptions of language; myth, metaphor and the foundations of civic life; rhetoric and the *sensus communis*; romanticism and nationalism; myth in democratic and totalitarian politics; and the structure of political culture.

Political Science 47.532F1 or W1

### **Democratic Theories**

Analysis of various theories of democracy and community, from classical to modern.

Political Science 47.534F1 or W1

### **Political Inquiry**

This seminar focuses on the major approaches to research in political areas as discussed in contemporary philosophy of the social sciences, exploring the variety of explanatory strategies in use in the contemporary study of politics.

Precludes additional credit for Political Science 47.570.

**Political Science 47.536F1 or W1  
North American Political Traditions**

A seminar on the interpretations that may include American, Mexican, anglo-Canadian and franco-Canadian political traditions.

Precludes additional credit for Political Science 47.535.

**Political Science 47.537F1 or W1  
Political Thought in North America**

Depending on student demand and faculty interest, a tutorial will be offered in topics related to the development of contemporary political thinking, including some more descriptive and contemporary topics such as the impact of religion and religiosity in political thought and culture.

Precludes additional credit for Political Science 47.535.

**Political Science 47.538F1 or W1  
Concepts of Political Community I**

A critical survey of concepts of political community, including the common good, justice, citizenship, statesmanship, democracy, and legitimacy, from ancient, modern, and contemporary political theory.

Precludes additional credit for Political Science 47.436.

**Political Science 47.539F1 or W1  
Concepts of Political Community II**

A continued critical survey of concepts of political community, including the common good, justice, citizenship, statesmanship, democracy, and legitimacy, from ancient, modern, and contemporary political theory.

Precludes additional credit for Political Science 47.437.

Prerequisite: Political Science 47.538 or permission of the Department.

**Political Science 47.541F1 or W1  
Canadian Public Administration and Policy Analysis**

The theory and practice of public administration in Canada, with emphasis on the federal level, including the role of the bureaucracy in policy making.

**Political Science 47.544F1 or W1  
Public Administration in Developed Western Countries**

A seminar in comparative public administration, with emphasis on Commonwealth countries, the United States, France, and West Germany.

**Political Science 47.545F1 or W1  
Public Administration in Developing Countries**

A seminar on the literature and characteristics of development administration; comparison by region, country, and topic.

**Political Science 47.546F1 or W1  
Topics in Public Affairs**

A seminar on selected topics in the role and impact of media, issues in public affairs and public policy.

**Political Science 47.549F1 or W1  
Research Seminar in Public Administration**

The content of this seminar will vary from year to year according to faculty research interests and student demand.

**Political Science 47.551S1  
Selected Issues in Political Economy I**

A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture, ideology, and social relations; and the labour process.

(Also listed as Political Economy 44.551 and Sociology 53.544)

**Political Science 47.552S1  
Selected Issues in Political Economy II**

A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture, ideology, and social relations; and the labour process. (Also listed as Political Economy 44.552 and Sociology 53.555)

**Political Science 47.553F1 or W1  
Topics in West European Politics**

This course is designed to deal intensively with domestic politics in Britain, France, Germany, Italy, and selected minor European powers.

Precludes additional credit for Political Science 47.550.

**Political Science 47.554F1 or W1  
Topics in West European Politics**

This course is designed to deal intensively with comparative and supra-national issues concerning the European Community, NATO, and other Western European institutions.

Precludes additional credit for Political Science 47.550.

**Political Science 47.555F1 or W1  
Topics in Comparative Politics I**

A research seminar dealing with a central theme of current research in comparative politics, such as: the effects of state policy and expenditure; technology and politics; political psychology; sex/gender and politics; the military and politics; Marxism and politics; religion and politics; studies in revolution; comparative parties and interest groups.



Political Science 47.556F1 or W1

**Sex/Gender and Politics**

Examines selected sex/gender dimensions of politics in comparative perspective. Topics may include: gendered nature of authority, sex/gender regimes and state forms; feminist accounts of citizenship, representation, power and democracy; women's movements and anti-feminist movements; identity politics; gendered accounts of nationalism and multiculturalism.

Political Science 47.557F1 or W1

**Social Movements, Interests and the State: Canada in Comparative Perspective**

This course examines major theoretical approaches to state-society relations in industrialized countries with particular attention to the role of social movements and organized interests. The theoretical approaches used to interpret and explain particular national outcomes include pluralism, neo-marxism, institutionalism, rational choice and post-modernism.

Political Science 47.559F1 or W1

**Governing in the Global Economy**

The course examines how national states respond to challenges of governing in an increasingly interdependent global economy. The course will be comparative in its focus, emphasizing advanced industrial societies primarily in western Europe and Canada.

Political Science 47.561F1 or W1

**Analysis of Canadian Foreign Policy**

A research seminar on contemporary Canadian external policies, with emphasis on the analysis of cases and issues, and comparisons with other national actors.

Political Science 47.567F1 or W1

**International Politics of North America**

An examination of continentalism in Canadian foreign policy during the twentieth century that charts regional, economic, political, and defence relations in North America. Also offered at the undergraduate level, with different requirements, as Political Science 47.467, for which additional credit is precluded.

Political Science 47.570F1 or W1

**Basic Research Methods**

A course in applied research design and methodology, with emphasis on empirical research strategies that are amenable to quantification. Master's students who have not completed Political Science 47.270 (or its equivalent) with high honours or better standing may be required to take this course.

Political Science 47.571F1 or W1

**Intermediate Polimetrics for Micro Data**

This course covers intermediate research de-

signs and statistical techniques primarily used in analyzing survey data. Selected topics may vary from year to year. Students intending to do research based on micro data are advised to take this course. Also offered at the undergraduate level, with different requirements, as Political Science 47.471, for which additional credit is precluded.

Prerequisite: Political Science 47.570 or permission of the Department.

Political Science 47.572F1 or W1

**Intermediate Polimetrics for Macro Data**

This course covers intermediate research designs and statistical techniques primarily used in analyzing macro or aggregate data. Selected topics may vary from year to year. Students intending to do research based on macro data are advised to take this course. Also offered at the undergraduate level, with different requirements, as Political Science 47.472, for which additional credit is precluded.

Prerequisite: Political Science 47.570 or permission of the Department.

Political Science 47.573F1 or W1

**Advanced Research Methods**

A course in advanced techniques of analysis. The focus of this research seminar is the use of various mathematical and statistical techniques in the construction and analysis of political theory. The seminar may include such topics as the translation of verbal theory into formal theory, the use of statistical techniques beyond regression and correlational analysis to examine political hypotheses, and index construction, including scaling and validation techniques.

Prerequisite: Political Science 47.570 or permission of the Department.

Political Science 47.581F1 or W1

**Foreign Policies of African States**

The foreign policy determinants and international behaviour of African states. Each year, the seminar focuses on a particular issue area. Precludes additional credit for Political Science 47.582.

Prerequisite: Permission of the Department.

Political Science 47.585F1 or W1

**Foreign Policy Analysis**

A research seminar dealing with selected problems in the study of foreign policy formulations and outcomes.

Political Science 47.586F1 or W1

**Strategic Thought and Issues in International Security**

A research seminar on the evolution of classical and contemporary strategic thought, as well as on current issues in international security.

Political Science 47.587F1 or W1

**Analysis of International Organizations**

A research seminar on process and change in contemporary forms of international organization.

Political Science 47.588F1 or W1

**International Political Economy**

A seminar on the changing international division of labour, and its consequences for world politics. Topics include differing patterns of industrialization, colonial relations, the role of the state, and current issues in international political economy. (Also listed as International Affairs 46.588)

Prerequisite: Work at a senior undergraduate level in at least two of the following: international relations, development studies, international trade, or political economy; or permission of the Department.

Political Science 47.589F1 or W1

**Problems in International Politics**

A workshop on significant issues in the study of international politics, with emphasis on the state of the field (and subfields) and problems in research.

Prerequisite: Political Science 47.560, or 47.660 and 47.661, or permission of the Department.

Political Science 47.590T2

**Tutorial in a Selected Field**

Tutorials or reading courses on selected topics may be arranged with the permission of the Department.

Political Science 47.591F1, W1, S1

**Tutorial in a Selected Field**

Tutorials or reading courses on selected topics may be arranged with the permission of the Department.

Political Science 47.598F2, W2, S2

**M.A. Research Essay**

Tutorial for students who write a research essay rather than a thesis.

Political Science 47.599F4, W4, S4

**M.A. Thesis**

Please note that courses numbered 47.600 through 47.661 are open to both M.A. and Ph.D. students.

Political Science 47.600F1

**The Political Process in Canada I**

An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups, and political leadership in Canada.

Precludes additional credit for Political Science 47.510.

Political Science 47.601W1

**The Political Process in Canada II**

An analytical study of the democratic political

process, with particular reference to political parties and elections, pressure groups, and political leadership in Canada.

Precludes additional credit for Political Science 47.510.

Political Science 47.615F1

**Comparative Politics I**

A research seminar dealing with theories, methods, and problems of comparison.

Precludes additional credit for Political Science 47.505.

Political Science 47.616W1

**Comparative Politics II**

A research seminar dealing with particular themes.

Precludes additional credit for Political Science 47.505.

Political Science 47.630F1

**Political Theory I**

An intensive examination of the major questions in classical, medieval, modern, and contemporary political philosophy. This political theory course is both historically comprehensive in scope and thematically oriented in depth.

Precludes additional credit for Political Science 47.530.

Political Science 47.631W1

**Political Theory II**

An intensive examination of the major questions in classical, medieval, modern, and contemporary political philosophy. This political theory course is both historically comprehensive in scope and thematically oriented in depth.

Precludes additional credit for Political Science 47.530.

Political Science 47.646F1

**Theories of Public Administration**

A seminar on theories of bureaucracy, organization, and comparison. Also offered at the undergraduate level, with different requirements, as Political Science 47.446, for which additional credit is precluded.

Political Science 47.647W1

**Public Policy: Content and Creation**

This course provides an opportunity to examine and apply major perspectives on the content and creation of public policy. The focus is on the explanation, prediction and design of policy. Perspectives and examples are drawn from a variety of frameworks and from both Canadian and non-Canadian contexts. Also offered at the undergraduate level, with different requirements, as Political Science 47.447, for which additional credit is precluded.

Political Science 47.648F1 or W1

**Public Affairs Management and Analysis**

This course examines how public and private sector organizations affect the climate of opinion relating to public policy and how they seek to change citizen behaviour. Topics include public affairs communication, political persuasion, corporate political agency, social marketing, health information campaigns, public affairs and electoral advertising, issue framing, polls, citizen group mobilization, and alliance building.

Precludes additional credit for Political Science 47.448.

Political Science 47.660F1

**Theory and Research in International Politics I**

An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it.

Precludes additional credit for Political Science 47.560.

Political Science 47.661W1

**Theory and Research in International Politics II**

An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it.

Precludes additional credit for Political Science 47.560.

Political Science 47.690F3, W3, S3

**Ph.D. Tutorials**

Ph.D. tutorials specifically designed as intensive preparation for the major field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examination.

Political Science 47.691F3, W3, S3

**Ph.D. Tutorials**

Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examinations.

Political Science 47.692F3, W3, S3

**Ph.D. Tutorials**

Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examinations.

Political Science 47.695F3, W3, S3

**Ph.D. Tutorials**

Ph.D. tutorials specifically designed as intensive preparation for the major field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examination.

Political Science 47.696T2

**Thesis Proposal Workshop**

Following a survey of general issues and problems in developing research proposals, students will prepare their own thesis proposal. Coordinated by one instructor, but faculty from other fields will also participate. The grade for this course will be Satisfactory or Unsatisfactory.

Prerequisite: Successful completion of comprehensive examinations or permission of the Department.

Political Science 47.699F10, W10, S10

**Ph.D. Thesis**



## Psychology

Loeb Building B552  
Telephone: 520-2644  
Fax: 520-3667

### The Department

**Chair of the Department, Kim Matheson**

**Departmental Supervisor of Graduate Studies, Jo-Anne LeFevre**

The Department of Psychology offers programs of study and research on a full-time and part-time basis, leading to the degrees of M.A., M.Sc. and Ph.D. Financial support is available, but is limited to full-time students.

There is a very close link in the Department of Psychology between graduate studies and research. Research in the Department is distributed across the life sciences areas of biopsychology, animal learning, perception, and cognition, and across the social sciences areas of social and developmental psychology. Its research and graduate program in biopsychology is one of the strongest in Canada, with current research focusing on problems of the neurochemistry of stress and learning; developmental psychopharmacology; experimental models of epilepsy; neuroanatomy; brain lateralization; neural mechanisms of audition; drug dependence; and the effects in animals and humans of prenatal alcohol and drug exposure on postnatal behaviour. The Department has related human neuropsychological research activities dealing with alterations to visual and auditory psychophysical functions associated with neuropathological conditions. In recent years, there has been a growth of activity in aspects of applied psychology, including evaluation research; corrections; education; impact of computer and telecommunications technology; behavioural medicine; and psychological assessment. This has fostered close collaborative contacts between the Department and public service and applied settings in Ottawa, such as the Children's Hospital of Eastern Ontario, the Royal Ottawa Hospital, the National Research Council, Department of Communications (Canada), Ontario Ministry of Correctional Services, and the Ottawa-Carleton Board of Education. Practica and internships are available in many of these settings to students at the doctoral level.

Because of the breadth of interests in the Department, there is an emphasis in graduate courses on methodological and conceptual issues that are applicable across research specializations. Consequently, most substan-

tive courses, regardless of title, are relevant to most students' programs. Students typically work very closely with their advisers who, through informal tutorials and directed studies and independent research courses, provide much of the opportunity for specialized study. Applicants are strongly encouraged to write directly to faculty members for more specific details on research interests and programs currently underway.

As part of its general experimental program, the Department provides the opportunity to pursue a concentration at the master's and doctoral level in biopsychology, behavioural neuroscience (a collaborative endeavour with the University of Ottawa), human neuropsychology, or human information systems. Applicants should consult with the supervisor of graduate studies for information on structuring a doctoral program of studies within a concentration.

Through a quantitative methods requirement, completion of a demanding empirical thesis presented and defended orally, participation in small seminars, and a close relationship with faculty advisers and students, the master's programs provides the opportunity for a refinement of critical, logical, and analytical skills; skills of written and oral expression; understanding of the strengths and limitations of the scientific method as a means of problem solving, demonstrated through psychology but applicable to issues in society at large; an understanding of quantification and scaling, the use of statistical methods and inference, and the use of evidence to support argument. For some students this is a satisfactory and satisfying end in itself. For others, it provides a solid preparation for the doctoral program in which original independent study and research is stressed. The Department does not distinguish between an applied and an experimental program; instead, the basic orientation is experimental and theoretical, but with opportunities, where appropriate, to provide complementary experience necessary to work successfully as a psychologist in applied research/service settings.

Augmenting the well-equipped laboratories expected in an active research environment, the Department of Psychology receives excellent technical support from the Carleton University Science Technology Centre, where design and manufacture of special-purpose apparatus is carried out. In addition, the workshops provide technical support for the more than twenty-five computer systems currently in use in laboratories throughout the Department.

These systems support a variety of computer languages, including FORTRAN, APL, PASCAL, and BASIC, several microcomputer emulatory programs, a variety of statistical and mathematical packages, such as the BMDP and SPSS systems, and many other programs.

In fulfilling degree credit requirements, all graduate students are required to demonstrate competence in statistical and quantitative methods through successful completion of Psychology 49.540 (with a grade of B- or better) or a qualifying examination. The qualifying examination is ordinarily scheduled during the first part of September, just prior to the registration period, and it encompasses the material covered in Psychology 49.540. In the event of successful completion of the examination, another course is substituted for Psychology 49.540. In the case of M.A. students, the Department may recommend that a grade of C+ in Psychology 49.540 be accepted for credit (General Regulations, Section 11.2) (see p. 60) only after successful completion of the qualifying examination. This option is limited to those who pass the examination within two successive offerings of it, and who maintain continuous registration as graduate students between the first registration in Psychology 49.540 and the taking of the examination.

In addition to fulfilling the remaining credit requirements as described in subsequent sections, all graduate students in psychology are expected to conduct research of interest to them during each year of graduate study. This requirement may be satisfied by independent research, serving as a research assistant, or by doing pilot or thesis research.

Each year, the candidate's adviser submits a written critique of research progress, and this becomes part of the candidate's permanent record. Qualifying-year students are evaluated at the end of the first twelve months.

Depending on his/her field of concentration, a candidate may be required to demonstrate an ability to read with understanding relevant technical material in a foreign language and/or to give satisfactory evidence of competence in such areas as computer techniques, electronic instrumentation, psychometrics, sampling procedures, or surgical techniques.

The Department may recommend that a graduate student be asked to withdraw from the program at any time if his or her progress in course work, research, or comprehensive examinations proves unsatisfactory.

Within the Department exist subgroups of faculty members with common interests and

subgroups of courses associated with particular areas of psychology. Below are listed four formally identified fields of concentration with the work which would be expected from any student who decided to pursue interests in one of these fields.

### Concentrations

#### *Basic and Applied Social Psychology*

The concentration in social psychology is designed to provide students with a fundamental knowledge in the traditional fields of social psychology such as social psychological research methods, attitudes and personality, as well as the application of social psychology to current social issues such as family violence, health promotion, assessment and program evaluation, crime and delinquency, computers and the psychology of women. Faculty interests span a broad spectrum of perspectives in social, personality, community and applied social psychology. Current research in the Department includes historical and critical social psychology, laboratory investigations of social processes in decision making and attitudes, through the applied studies in areas such as family violence, women and the work force, the psychology of women, delinquency, criminal justice and corrections, health promotion, and performance enhancement.

Students interested in this area are encouraged to take courses such as 49.510, 49.511, 49.519 and 49.546, as well as generate theses in this area.

#### *Concentration in Biopsychology*

Biopsychology is the study of the structure and function of the central nervous system. Neuroanatomical, neurophysiological, neurochemical, and behavioural methods are used to investigate brain mechanisms underlying psychological processes. The recommended courses for students in biopsychology are 49.520, 49.620, 49.624 and 49.625, followed by additional specialized courses, directed studies and independent research credits to be determined in consultation with a thesis adviser. It should be noted that one of the neuroscience techniques courses (49.624 or 49.625) can be substituted for one of the following 0.5 credit courses to satisfy the Ph.D. program requirement in statistics: 49.541, 49.542, 49.543 or 49.546. This course pattern is available to all graduate students in the biopsychology concentration in the Department of Psychology. An alternative program is offered through the Ottawa-Carleton Specialization in Neuroscience. The details of this program are outlined separately on p. 261 of this calendar.

*Concentration in Cognitive Psychology*

The concentration in cognition is intended to provide the graduate student with an advanced knowledge of methodological and theoretical issues in the domain of cognitive psychology. Research interests of regular and adjunct faculty in cognition include perception and psycho-physics, attention, pattern recognition, reading and language processing, cognitive development, learning and memory, problem solving, neuropsychology, and human-computer interactions. Students interested in this area are encouraged to take courses such as 49.570, 49.573, 49.574 and 49.670 and generate theses in the area of cognition.

*Concentration in Neuropsychology*

Concentration in the area of neuropsychology occurs at the Ph.D. level. It is designed to provide students with background and skills relating to the diagnosis and evaluation of psychological disorders that arise from neurological problems and associated brain dysfunction syndromes. Students interested in this area are encouraged to take all four Ph.D. seminars: 49.661, 49.662, 49.663 and 49.664. Also, it is expected that students in this field generate theses in neuropsychology.

**Qualifying-Year Program**

Occasionally, candidates with exceptional promise who offer less than Honours B.A. status may be admitted to a qualifying-year program approved by the graduate studies committee and designed to prepare them for master's study. A grade of B- or better must be obtained in each qualifying-year course, and candidates may be required to complete satisfactorily the equivalent of an B.A. (Honours) thesis.

**Master of Arts****Admission Requirements**

The normal requirement for admission into the master's program is an B.A. (Honours) (or its equivalent) with high honours standing and with credit in the following areas: statistics and design of experiments; experimental psychology; learning or motivation; physiology and/or comparative psychology; and history and/or systems.

Candidates with particular course deficiencies may be required to register in additional courses at Carleton.

The deadline for submitting applications for graduate study in psychology are as follows: February 1 for students requesting financial assistance; June 1 for students not requesting financial assistance but who are seeking ad-

mission in September; and November 1 for students not requesting financial assistance who are seeking admission in January.

**Program Requirements**

The master's program usually consists of 3.0 credits, of which at least two must be at the graduate level (numbered 500 or higher), and a thesis (equivalent to 2.0 credits) which must be defended at an oral examination. Psychology 49.540, or the successful completion of the opting-out examination in quantitative methods, is required of all graduate students. Course credit will not be given for successful completion of the opting-out examination.

**Master of Science**

The Department of Psychology offers the M.Sc. degree for those students in the biopsychology concentration or the neuroscience specialization. For the neuroscience specialization, the candidate must fulfill the normal program requirements together with the requirements of the specialization. For further details, see p. 261.

**Academic Standing**

A grade of B- or better is normally required in each of the credits counted towards the M.A. or M.Sc. degree. The Department is prepared on occasion to recommend to the Dean of the Faculty of Graduate Studies and Research that a candidate be allowed a grade of C+ in 1.0 credit or each of two 0.5 credits. In the case of Psychology 49.540, such a recommendation will be based on successful completion of the qualifying examination. This option is limited to those who pass the examination within two successive offerings of it, and who maintain continuous registration as graduate students between the first registration in Psychology 49.540 and the taking of the examination.

**Doctor of Philosophy****Admission Requirements**

The requirements for admission to the Ph.D. program are outlined in the General Regulations section of this Calendar (see p. 51). Scores on the Graduate Record Examination are also optional.

The Ph.D. program in psychology normally will be undertaken on a full-time basis; however, in cases of exceptional merit, the Department will accept a few candidates for the degree on a part-time basis. The time limit for completion of Ph.D. degree requirements for those who enter the program on a part-time



basis will be the same as for those who enter on a full-time basis and subsequently register for part-time study: that is, eight calendar years. (See General Regulations, Section 13, Time Limits) (p. 63).

Applicants should note that of the B.A., M.A., M.Sc., and Ph.D. degrees in Psychology, only two may ordinarily be taken at Carleton University.

### Program Requirements

The minimum program requirements for the Ph.D. degree in Psychology are as follows:

\* 10.0 credits, with a grade of B- or better in each credit

\* Psychology 49.540 (1.0 credit) or the opting-out examination; and one of Psychology 49.541, 49.542, 49.543 or 49.546 or other as approved by the graduate committee are required of all Ph.D. graduate students. In the case of success in the opting-out examination in 49.540, another 1.0 credit is substituted

\* Satisfactory completion of Psychology 49.695 (1.0 credits)

\* A thesis equivalent to 5.0 of the required 10.0 credits which must be defended at an oral examination

All Ph.D. candidates are required to submit a thesis prospectus. The prospectus examination will normally be successfully completed within seven calendar terms of the student's initial registration for full-time students and ten terms for part-time students.

### Comprehensive Examination

All Ph.D. candidates in psychology are required to successfully complete Psychology 49.695, Comprehensive Examination (1.0 credit). The Comprehensive examination includes both a written and an oral examination on a topic distinct from the topic of the thesis. The topic of the comprehensive examination shall be approved by the graduate studies committee of the Department of Psychology. There are two optional forms for the written and the oral examination: either a major essay or a research grant proposal. The submission of the written portion of the examination will be followed within one to three weeks by a comprehensive oral examination, which is not restricted to issues raised by the written portion.

Ordinarily the comprehensive examination must be completed successfully before the Ph.D. prospectus meeting is scheduled. Student's are normally required to register in the Comprehensive Examination by the fourth

term of the student's initial registration for full-time students in the Ph.D. program or by the seventh term of the student's initial registration in the part-time Ph.D. program.

### Graduate Courses

**Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.**

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Through inter-university cooperation in graduate instruction, full-time graduate students registered in the Department of Psychology may enrol in one course at the University of Ottawa.

Psychology 49.510F1

#### **Research Methods in Social Psychology**

This course focuses on essential methodological issues in social psychology. These include experimental, quasi-experimental, correlational, survey and field research methods, as well as factors affecting the validity of findings and ethics.

Psychology 49.511W1

#### **Seminar in Social Psychology**

This seminar deals with classic and current theoretical issues and research findings in the areas of social psychology, personality, community, social-developmental and applied social psychology.

Psychology 49.512F1, W1

#### **Group Processes**

The interface between the person and the group has been alleged to be the uniquely defining feature of social psychology. This course examines the evidence for this assertion historically, and across cultures, in an attempt to place current publications in group processes in broader temporal and cultural contexts than research reports normally permit.

Psychology 49.513F1, W1

#### **Attitudes**

This seminar will survey classic and contemporary theories and research examining the nature of attitudes, the attitude-behaviour relation, and factors affecting attitudes.

Psychology 49.514F1, W1

#### **Psychology of Women**

This seminar will consider and evaluate research concerning the psychology of women,

including research methods, gender roles and gender differences.

Psychology 49.515F1

### **Fundamentals of Computing for Psychologists**

A survey of computer and communication hardware and software. The purpose of the course is to make psychologists aware of the concepts and terminology used by engineers and programmers in planning computer applications; it is not designed to train students to be programmers or to build equipment. The course will have a weekly laboratory.

Prerequisite: One course in computer programming.

Psychology 49.516F1

### **Applications of Computers to Thinking, Problem Solving, and Decision Making**

A survey of literature in such fields as artificial intelligence, database management, computer-aided instruction, simulation and forecasting, and computer-mediated communication. Psychological principles in the design, use, and evaluation of these cognitive aids will be stressed.

Prerequisite: Psychology 49.515.

Psychology 49.517F1, W1

### **Psychology of Family Violence**

This seminar takes an eclectic approach to the study of child abuse, wife-assault, and other forms of family violence. In an effort to understand the psychological processes associated with family violence, theoretical and empirical work from social, developmental, and community psychology will be considered. In addition, the extent to which early experience of abuse affects the development and functioning of neuroanatomical structures will be examined.

Psychology 49.518F1

### **Social Psychological Issues in Human Assessment**

A detailed critique of orthodox assessment methodologies and exposure to recent developments in the appraisal of human competencies, personality, and social interaction.

Psychology 49.519F1, W1.

### **Historical and Social Foundations of Social Psychology**

This course surveys the development of social psychology from the 1850s to the present in both Europe and North America. Emphasis is placed on the development of social psychology as an experimental science within psychology. Part of the course will examine current trends in the sociology of knowledge and the social studies as they apply to social psychology.

Psychology 49.520T2 (PSY6201)

### **Basics of Neuroscience**

A comprehensive neuroscience course from the membrane and the cellular levels through to the behavioural aspects of invertebrates and vertebrates. Lectures and tutorials will cover such aspects of neuroscience as neuroanatomy, neurophysiology, behavioural neuroscience and neuropharmacology.

(Also listed as Biology 61.534)

Psychology 49.521F1, W1

### **Environmental Psychology and Social Ecology**

Using a combination of lectures and seminar presentations, this course considers theory, methods, research and applications in the fields of environmental psychology and social ecology. Topics include spatial behaviour, cognitive mapping, territoriality, behaviour setting analysis, personal space, crowding, environmental dispositions, psychological assessment of environments, social ecological models of stress and health promotion, and psychological aspects of architectural and environmental design. The course is designed for psychology students but may be of interest to advanced students in the fields of geography, sociology and architecture. For those who are not graduate students in psychology, permission to register in the course is required from the instructor.

Psychology 49.522F1, W1

### **Psychology and Criminal Justice**

A critical review of the contributions of psychological concepts, technology and research methodology to the analysis of selected issues in law and criminal justice. Topics may include victim studies, forensic psychology, police studies, expert testimony, eyewitness and bystander behaviour, judicial decision making, the psychologist as advocate and apologist, and the social psychological status and functioning of criminal justice and correctional practitioners. The ethics of psychological intervention in criminal justice are reviewed, along with critiques of criminal justice policy.

Psychology 49.523F1, W1

### **Psychology in the Human Services**

This seminar will review and evaluate non-clinical roles for psychologists in the human services. The major roles reviewed include those of consultant, researcher, evaluator, trainer, and policy analyst. Illustrative efforts in a variety of settings will be reviewed with particular attention to conditions which facilitate and inhibit organizational change and the adoption, implementation and maintenance of innovative programming.

## Psychology

Psychology 49.524F1, W1

### **Principles and Methods in Behavioural Toxicology**

A 0.5 credit course (one term) examining the basic concepts of behavioural toxicology starting with a general discussion of behaviour testing methodology and then focusing on procedures used in screening chemicals for behavioural effects, and more advanced tests. Controversial examples from current research are used to illustrate the practical problems of assessing both animal and human behavioural toxicity.

Psychology 49.529F1 or W1

### **Psychology of Health and Illness**

A critical examination of scientific theory and research on the role of psychological factors in health and illness, and the use of psychological interventions in treating illness and maintaining health. Topics include the biopsychological model of illness, stress and coping, psychoneuroimmunology, personality, and issues in intervention, such as placebo effects and hypnosis.

Psychology 49.530W1

### **Perceptual Processes**

Theoretical and empirical issues of the area of perception. The topics may include: psychophysics, constancies, depth perception, pattern recognition, iconic memory, attention, hemispheric specialization.

Psychology 49.531F1, W1

### **Psychophysics**

A study of classic and contemporary psychophysical methods. Applications to cognition will be included.

Psychology 49.540T2

### **Quantitative Psychology I: Univariate Techniques**

Applications of the general linear model including analysis of variance and multiple regression: prediction and estimation. Extensive use is made of computer statistical packages.

Psychology 49.541F1

### **Quantitative Psychology II: Multivariate Techniques**

Applications of multivariate statistical techniques with psychological data including multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor analysis. Extensive use is made of computer statistical packages.

Prerequisite: Psychology 49.540.

Psychology 49.542W1, S1

### **Descriptive and Nonparametric Statistics**

An overview of methods for assisting in the detection and explanation of patterns in data that do not satisfy parametric test assumptions.

Topics may include exploratory data analysis, information analysis, prediction analysis, ordinal pattern analysis, and conceptual issues in statistics.

Prerequisite: Psychology 49.540.

Psychology 49.543W1, S1

### **Measurement and Scaling: Theory, Methods, and Applications**

An examination of the various fundamental measurement and derived measurement and scaling systems encountered in the social and behavioural sciences. Theoretical foundations and applications of extensive, conjoint, difference, utility and subjective probability, similarity and preference systems are studied. Multidimensional scaling of similarities and preference data is emphasized as is use of the available computer based routines.

Prerequisite: Psychology 49.540.

Psychology 49.546W1, S1

### **Quasi-experimental Design and Evaluation Research**

Coverage of methodological and statistical problems occurring in the field settings and program evaluations.

Prerequisites: Psychology 49.540, and one of 49.541, 49.542, 49.543.

Psychology 49.547F1

### **Tests and Measurements I: Intellectual/Cognitive**

This course is designed to assist students learning of basic cognitive/intellectual assessment procedures. Students will be required to administer and interpret a variety of tests such as the WAIS-R, Wechsler Memory Scale, Rey Auditory Verbal Learning Test, and Buschke's Cued Recall Test.

Prerequisite: Undergraduate course in testing or psychometrics.

Psychology 49.548W1

### **Tests and Measurements II: Personality**

This course is designed to assist students learning of basic projective and non-projective personality tests. Students will be required to administer and interpret a variety of personality tests such as MMPI, Rorschach, 16-PF, and STAI. Applied experience will be stressed.

Prerequisite: Psychology 49.547.

Psychology 49.551F1

### **Developmental Psychology I**

A detailed examination of selected issues in developmental psychology.

Psychology 49.552W1

### **Developmental Psychology II**

A continuation of 49.551.

Psychology 49.561W1

### **Contemporary Research in Personality**

Current controversial issues in personality



research, and selected theoretical and research studies in personality.

Psychology 49.570F1

### **Advanced Topics in Cognition I**

An in-depth study of a specific topic in the area of basic cognitive processes. Topics will vary from year to year and may include judgmental processes, object identification, selective attention and spatial cognition.

Psychology 49.573W1

### **Cognition I**

A survey of issues and research methodologies in basic cognitive processes. Topics may include detection and processing of sensory signals, pattern recognition, attention, mental imagery and automaticity.

Psychology 49.574W1

### **Cognition II**

A survey of issues and research methodologies in higher-level cognitive processes. Topics may include memory, representation of knowledge, decision processes, and the procedural/declarative controversy. The course may be focused on a particular area (e.g. reading, transfer in problem solving).

Psychology 49.576W1

### **Behaviour Modification**

Special problems, topics, and projects related to behaviour modification.

Psychology 49.580F1, W1, S1

### **Special Topics in Psychology**

The topics of this course will vary from year to year, and will be announced in advance of the registration period.

Psychology 49.590F1, W1, S1

### **Directed Studies**

An investigation in depth of selected problems in psychology by means of directed library research. Registration is restricted, permission to register being granted only by the graduate committee. A final report must be filed in the departmental office prior to submission of course grade.

Psychology 49.591F1, W1, S1

### **Independent Research**

Permission to register and approval of research plan must be obtained from the graduate committee. A final research report must be filed in the departmental office prior to submission of course grade. The course may be repeated for credit.

Psychology 49.593F1, W1

### **Practicum in Psychology**

The practicum offers graduate students experience in a range of applied psychology settings (for example, hospitals, schools, and correctional centres). Students participate in training

sessions and work experience, facilitating the integration of academic and practical aspects of psychology. It is designed to supplement the course material offered at Carleton and should not be viewed as constituting a clinical internship. This course is only available to master's students and cannot be repeated for credit. Students will receive a grade of satisfactory or unsatisfactory. Details of the current practicum placements are available from the Department.

Psychology 49.599F4, W4, S4

### **M.A. Thesis**

Psychology 49.600F1

### **Systems of Psychology**

Historical research methods on the study of psychological movements and problems of the late nineteenth and early twentieth centuries; may be repeated for credit. (Open with permission to advanced undergraduates.)

Psychology 49.613F1 or W1

### **Sleeping and Dreaming**

Modern research in sleeping and dreaming will be examined from different perspectives. Major emphasis will be placed on recent theory, method and measurement in sleep and dream research from the points of view of developmental neuro-cognition, psychophysiology and chronobiology. Disorders of sleeping behaviour and experience in children and adults will be considered as will cross-species comparative approaches. The course will focus on the functions of sleeping and dreaming and examine the effects of these behaviours on waking behaviour and experience.

Psychology 49.615F1

### **Psychological Aspects of Computer Use**

An investigation of human factors related to the effective design of computer hardware and software. Topics may include the design and evaluation of information search procedures, graphic displays, and operation manuals on the assessment of usability. A research project will be required.

Psychology 49.616W1

### **Social Aspects of Computer Use**

An investigation of the social psychological and political factors affecting the adoption and use of computers. Topics may include the design and evaluation of training programs, the assessment of attitudes towards computers, threats to privacy and jobs, and computer crime. Emphasis will be placed upon the organizational and interpersonal changes resulting from the introduction of computers into work settings. A research project will be required.

## Psychology

Psychology 49.620T2

### **Advanced Seminar in Neuroscience**

A comprehensive proseminar covering specialized topics in neuroscience and biopsychology. The presentations will focus on the active research areas and interests of faculty members and will provide an in-depth coverage of research strategies, methods and results. Graduate student presentations of current research projects will be an integral part of the course. (Also listed as Biology 61.633) Prerequisite: Psychology 49.520.

Psychology 49.624F1 (ANA7400)

### **Neuroscience Techniques I**

Completion of a research project carried out under the supervision of a neuroscience faculty member. Students may carry out their project in any department participating in the neuroscience specialization provided they have approval from the administrative head of their particular program. For example, students in the neuroscience specialization must obtain approval from the neuroscience committee. Students in the biopsychology concentration must obtain approval from the Department of Psychology. Credit will be granted for learning new research techniques. (Also listed as Biology 61.623)

Psychology 49.625W1 (ANA7400)

### **Neuroscience Techniques II**

Completion of a research project carried out under the supervision of a neuroscience faculty member. Students may carry out their project in any department participating in the neuroscience specialization provided they have approval from the administrative head of their particular program. For example, students in the neuroscience specialization must obtain approval from the neuroscience committee. Students in the biopsychology concentration must obtain approval from the Department of Psychology. Credit will be granted for learning new research techniques. (Also listed as Biology 61.624).

Psychology 49.627F1

### **Neuroscience Techniques III**

Completion of a research project carried out under the supervision of a neuroscience faculty member. Students may carry out their project in any department participating in the neuroscience specialization provided they have approval from the administrative head of their particular program. For example, students in the neuroscience specialization must obtain approval from the neuroscience committee. Students in the biopsychology concentration must obtain approval from the Department of Psychology. Credit will be granted for learning new research techniques.

Psychology 49.628W1

### **Neuroscience Techniques IV**

Completion of a research project carried out under the supervision of a neuroscience faculty member. Students may carry out their project in any department participating in the neuroscience specialization provided they have approval from the administrative head of their particular program. For example, students in the neuroscience specialization must obtain approval from the neuroscience committee. Students in the biopsychology concentration must obtain approval from the Department of Psychology. Credit will be granted for learning new research techniques.

Psychology 49.650F1

### **Research Seminar in Developmental Psychology I**

Psychology 49.651W1

### **Research Seminar in Developmental Psychology II**

Psychology 49.661F1

### **Seminar in Human Neuropsychology I**

A broad and intensive consideration of selected topics in human neuropsychology, integrating findings from psychology with related medical literature.

Psychology 49.662W1

### **Neuropsychological Assessment**

Review of the rationale and practice of diagnosis and treatment based on neuropsychological test results. The reliability and validity of test batteries such as the Halstead-Reitan and the Luria-Nebraska are studied. A variety of methods of test interpretation are utilized in clinical analysis of patient protocols, including degenerative diseases, psychiatric disorders, seizures, head injury, and brain tumors. Prerequisite: Psychology 49.661.

Psychology 49.663F1

### **Seminar in Human Neuropsychology II**

A broad and intensive consideration of selected topics in human neuropsychology, integrating findings from psychology with related medical literature.

Psychology 49.664W1

### **Theories of Brain Dysfunction in Psychopathology**

A review of neuropsychological theoretical explanations and empirical findings regarding brain functioning in a variety of organic and psychiatric disorders, such as autism, schizophrenia, minimal brain dysfunction, anorexia nervosa, aphasia, and memory disorders. These disorders are examined from neurological, psychological, biochemical, and neuropsychological points of view. Prerequisite: Psychology 49.661.

Psychology 49.666W1

**Sensory Neuroscience**

The anatomy and physiology of sensory processing will be discussed with particular reference to neural mechanisms and perceptual functions. The course will concentrate on specific sensory systems and provide an in-depth coverage of selected topics to be determined by the instructor.

Psychology 49.667W1

**Psychopharmacology**

A seminar for the discussion of the neurochemical and behavioural effects of various psychoactive substances.

Psychology 49.670F1, W1

**Advanced Topics in Cognition II**

An in-depth study of a specific topic in higher-level cognitive processes. Topics will vary from year to year and may include mathematical knowledge and processes, problem solving, or models of reading.

Psychology 49.680F1, W1

**Special Topics in Psychology**

The topics of this course will vary from year to year, and will be announced in advance of the registration period.

Psychology 49.690F1, W1, S1

**Directed Studies**

Same description as 49.590.

Psychology 49.691F1, W1, S1

**Independent Research**

Permission to register and approval of research plan must be obtained from the graduate committee. A final research report must be filed in the departmental office prior to submission of course grade. The course may be repeated for credit.

Psychology 49.693F1, 49.694W1

**Practicum in Psychology**

The practicum offers graduate students experience in a range of applied psychology settings (for example, hospitals, schools, and correctional centres). Students participate in training sessions and work experience, facilitating the integration of academic and practical aspects of psychology. Practica are designed to supplement the course material offered at Carleton and should not be viewed as constituting a clinical internship. These courses are only available to Ph.D. students and cannot be repeated for credit. Students will receive a grade of *Satisfactory* or *Unsatisfactory*. Details of the current practicum placements are available from the Department.

Psychology 49.695F2, W2, S2, T2

**Comprehensive Examination**

Available only to Ph.D. students. Students will receive a grade of *Satisfactory* or *Unsatisfactory*.

Psychology 49.699F, W, S

**Ph.D. Thesis**



## Public Administration

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### The School

**Director of the School, F.D. Abele**

**Coordinator, Canadian Concentration, D.G. Swartz**

**Coordinator, Development Concentration, M.A. Bienefeld**

**Coordinator, Innovation, Science and Environment Concentration, K. Newton**

**Coordinator, Doctoral Program, S.D. Phillips**

The School of Public Administration at Carleton University is a leading national and international centre for teaching and research in public administration and public policy. Since being established in 1953, the School has helped to prepare individuals for professional careers and opportunities in the public sector, both in Canada and abroad.

The nature of the public sector has always been subject to change, but perhaps never more than in recent years. Today the public sector can be seen as embracing not only the traditional government departments and agencies, but also political organizations, interest groups, consulting and research firms, the voluntary sector, organizations that provide public services on contractual bases, as well as international agencies and institutions of higher learning. The graduate programs of the School treat the public sector in this contemporary context.

The School offers graduate programs of study and research in the fields of public administration and public policy leading to the Master of Arts in Public Administration, the Graduate Diploma in Public Administration, and the Doctor of Philosophy in Public Policy. These programs are designed both for individuals who wish to work in the public sector, and for those who are already doing so but who wish to broaden or strengthen their conceptual and technical skills. Prospective applicants are urged to consider carefully the alternative programs so as to select the one best suited to their interests, background, and academic qualifications.

The M.A. program provides a broad and balanced exposure to public policy development,

public management and policy implementation. The D.P.A. program provides an introduction to the same subjects. Both the M.A. and the D.P.A. are offered in three alternative areas of concentration:

Canadian public administration and policy (the Canadian Concentration); development administration (the Development Concentration); and Innovation, Science and Environment Policy. The Development Concentration is offered in cooperation with the Norman Paterson School of International Affairs.

The Ph.D. program involves the intensive study of the formation and evolution of public policy in Canada and, from a comparative perspective, in countries of the OECD.

Each of these graduate programs is described in detail below. Further information or application packages can be obtained by contacting the School of Public Administration.

### Master of Arts

The overall objective of the M.A. program is to provide individuals with a balanced conceptual and technical ability to understand and contribute to policy development, public management, and policy implementation.

Under this objective, the Canadian Concentration provides an advanced understanding of the public sector through interdisciplinary insights drawn from political science, economics and management, as applied within the framework of Canadian and comparative institutions, laws and ideas. It also enables individuals to specialize in particular policy fields and aspects of management, both through study and through cooperative education in the public sector.

The Development Concentration provides an advanced understanding of the problems and opportunities that confront various types of national administrative systems and public sectors in their efforts to promote sustainable social and economic development in an increasingly interdependent and competitive global system.

The Innovation, Science and Environment Policy Concentration provides an advanced understanding of the problems and opportunities that confront governments, firms and society in making and implementing innovation, science and environment policies in an increasingly knowledge and information-based economy and society.

These overall and particular objectives are consistent with the School's view of what is

fundamental to education in the field of public administration. This view is:

- \* that democratic ideals and practices are central to government and to the public sector broadly defined
- \* that a balance of conceptual and technical skills is needed to understand the linked activities of policy development (how and why policy is made), public management (how the public sector is structured, staffed and resourced) and policy implementation (how policy intentions are carried out, including the grievances and appeals of citizens and clients)
- \* that these advanced conceptual and technical skills come from exposure to a variety of academic disciplines
- \* that professional education in public administration and policy analysis requires a balance of theory and practice

The relevance of this view has been borne out by the success of graduates of the School who now work in many areas of the public sector, in Canada and abroad, including government departments, political organizations, interest groups, consulting and research firms, the voluntary sector, international agencies, and institutions of higher learning.

A co-op option is available to full-time students in the M.A. program. Students admitted to this option must satisfactorily complete at least two work terms in order to graduate with a co-op designation on their transcripts and diplomas. These work terms are four months in duration and locate students in government departments or other organizations in order to work at a junior officer level. They provide students with opportunities to integrate the theoretical and practical aspects of public administration. During a work term, students will register in one of the co-op work term courses: Administration 50.531, 50.532, or 50.533. While on a work term, students are limited to an additional 0.5 credit course.

### Program Schedules

The M.A. program may be taken under three schedules: full time, part-time or a mixture of the two.

- \* The full-time schedule enables students to complete the program in two years (four or five academic terms).
- \* The part-time schedule enables students, taking from two to four half credits over one year, to complete the program in five to eight years. Courses are regularly scheduled in evening sections.

- \* The mixed full-time, part-time schedule enables students to complete the program in a period intermediate to those above. The mixed schedule applies to full-time students who shift to part-time study during a cooperative placement, or part-time students who shift to full-time study in the event of study leave.

The duration of the program depends upon the advanced standing with transfer of credit that students receive upon admission. Advanced standing is discussed below under program requirements.

### Admission Requirements

Applicants must have a demonstrated ability to study and communicate in English. A TOEFL score of 580 or higher is normally required for students whose first language is not English.

Applicants must have a bachelor's degree (or the equivalent) with high honours standing or better from a recognized university. The level of academic performance and potential demonstrated within the degree is more important than the discipline. Indeed, students enter the program from a wide variety of academic backgrounds in the social sciences, humanities, sciences and engineering. The School also considers mid-career applicants who do not have a bachelor's degree, but who have demonstrated professional excellence over several years of managerial work in the public sector.

Applicants must have completed a university course covering micro- and macroeconomic theory (Economics 43.100 or the equivalent), with the required standing. In addition, applicants must have a working knowledge of algebra.

Applicants to the Canadian Concentration and the Innovation, Science and Environment Concentration must have completed one university course in Canadian government (47.200 or the equivalent), with the required standing.

Applicants to the Development Concentration must have completed at least three years of relevant work experience on development projects or in the areas of development assistance or development planning.

Note that, because of the number of applications received, possession of these admission requirements does not, in itself, guarantee admission to the program.

Application packages may be obtained by contacting the School of Public Administration. Applicants for full-time study who wish to be

considered for financial assistance and scholarships must ensure that all application materials are received by March 1.

### Program Requirements

The M.A. program comprises 10.0 credits. Upon admission, students may receive advanced standing with transfer of credit for up to 4.0 required credits. Under the Canadian Concentration no more than three of these courses may be from 50.504, 50.510, 50.511, 50.524, and 50.563. Under the Development Concentration, no more than two of these courses may be from 50.511, 50.517, 50.524, 50.552, and 50.588. Under the Innovation, Science and Environment Concentration no more than two of these courses may be from 50.501, 50.502, 50.508 and 50.587. Advanced standing is granted only if previous academic work is judged to be equivalent to the required courses. Advanced standing will be determined on an individual basis on consultation with the School and the Faculty of Graduate Studies and Research and pursuant to Section 6.1 of the General Regulations section of this Calendar. In general, a grade of B+ or better is necessary in the equivalent courses in order to receive advanced standing.

The composition of the required and optional courses that make up the M.A. program differs between the Canadian, the Development, and the Innovation, Science and Environment Policy Concentrations.

#### *Canadian Concentration*

##### *10.0 credits consisting of:*

##### **A. 6.0 required credits:**

- (i) Administration 50.500  
Administration 50.522  
Administration 50.523  
Administration 50.530  
Administration 50.536  
Administration 50.551  
Administration 50.552  
Administration 50.567  
Administration 50.568
- (ii) 1.5 credits chosen from:  
Administration 50.504  
Administration 50.510  
Administration 50.511  
Administration 50.524  
Administration 50.563

##### **B. 4.0 optional credits consisting of:**

- (i) 0.5 credit selected from each of streams 1, 2 and 3 listed below, and 2.5 credits selected from any of the streams, or from graduate courses in other disciplines if approved by the graduate supervisor; or
- (ii) A thesis (equivalent to 2.0 credits) and 2.0 credits selected from any of the streams, or from graduate courses in other disciplines, if approved by the graduate supervisor; or
- (iii) A research essay (equivalent to 1.0 credit) and 3.0 credits selected from any of the streams, or from graduate courses in other disciplines, if approved by the graduate supervisor

Note that students may take as options any of the required courses over and above the minimum number specified.

#### *Development Concentration*

##### *10.0 credits consisting of:*

##### **A. 5.5 required credits:**

- (i) Administration 50.501  
Administration 50.523  
Administration 50.530  
Administration 50.551  
Administration 50.563  
Administration 50.568  
International Affairs 46.507  
International Affairs 46.508  
International Affairs 46.537

##### **(ii) 1.0 credit chosen from:**

- Administration 50.511  
Administration 50.517  
Administration 50.524  
Administration 50.552  
Administration 50.588

##### **B. 4.5 optional credits consisting of:**

- (i) 4.5 credits from streams 1, 2 and 3 listed below, or from graduate courses in other disciplines if approved by the graduate supervisor; or
- (ii) A thesis (equivalent to 2.0 credits) and 2.5 credits selected from any of the streams, or from graduate courses in other disciplines, if approved by the graduate supervisor; or
- (iii) A research essay (equivalent to 1.0 credit) and 3.5 credits selected from any of the streams, or from graduate courses in other



disciplines, if approved by the graduate supervisor

Note that students may take as options any required courses over and above the minimum number specified.

*Innovation, Science and Environment Policy Concentration*

**A. 10.0 credits consisting of:**

**(i) 7.0 required credits:**

Administration 50.523

Administration 50.530

Administration 50.540

Administration 50.541

Administration 50.543

Administration 50.544

Administration 50.551

Administration 50.552

Administration 50.560

Administration 50.567

Administration 50.568

One of Business 42.570 or Business 42.571

**(ii) 1.0 credit chosen from:**

Administration 50.501

Administration 50.502

Administration 50.508

Administration 50.587

**B. 3.0 optional credits consisting of:**

**(i)** 0.5 credit selected from each of Stream 1, 2 and 3 listed below, and 1.5 credits selected from any of the streams, or from graduate courses in other disciplines if approved by the graduate supervisor, or

**(ii)** A thesis (equivalent to 2.0 credits) and 1.0 credits selected from any of the streams, or from graduate courses in other disciplines if approved by the graduate supervisor, or

**(iii)** A research essay (equivalent to 1.0 credit) and 2.0 credits selected from any of the streams, or from graduate courses in other disciplines if approved by the graduate supervisor.

Note that students may complete as options any of the required courses over and above the minimum number specified.

### **Stream 1 - Policy Fields**

50.508, 50.509, 50.540, 50.559, 50.560, 50.564, 50.570, 50.571, 50.572, 50.573, 50.574, 50.586, 50.587, 50.588, 50.589

### **Stream 2 - Public Management and Institutional Relations**

50.503, 50.506, 50.515, 50.516, 50.517, 50.519, 50.538, 50.541, 50.581, 50.584

### **Stream 3 - Advanced Analysis**

50.502, 50.507, 50.513, 50.520, 50.525, 50.528, 50.537, 50.543, 50.544, 50.562, 50.569, 50.575

### **Academic Standing**

All candidates are required to obtain a grade of B- or better in each course in the program. A candidate may, with the recommendation of the School and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed one grade of C+.

### **Graduate Diploma in Public Administration**

The D.P.A. program provides an introduction to the subjects of policy development, public management, and policy implementation. Students enter the program with widely varying backgrounds, including those who already have advanced degrees but who wish to strengthen or broaden their conceptual and technical skills in public administration.

### **Program Schedules**

The D.P.A. program can be taken under three schedules; full time, part time or a mixture of the two. The duration of the program is approximately half that described for the M.A. program.

### **Admission Requirements**

The requirements for admission to the Canadian, the Development and the Innovation, Science and Environment, Policy Concentrations of the D.P.A. are identical to those described for the M.A. Note, however, that students in the D.P.A. are not eligible to receive financial assistance.

### **Program Requirements**

The D.P.A. program comprises 5.0 credits. Upon admission, students may receive advanced standing with transfer of credit for up to 1.0 credit. Advanced standing is granted only if previous academic work is judged to be equivalent to those courses. Advanced standing will be determined on an individual

basis on consultation with the School and the Faculty of Graduate Studies and Research and pursuant to Section 6.1 of the General Regulations section of this Calendar. In general, a grade of B+ or better is necessary in the equivalent courses in order to receive advanced standing.

The composition of courses that make up the D.P.A. program differs between the Canadian, the Development, and the Innovation Science and Environment Policy Concentrations.

### *Canadian Concentration*

#### *5.0 credits selected from:*

- \* Administration 50.500
- \* Administration 50.504
- \* Administration 50.510
- \* Administration 50.511
- \* Administration 50.522
- \* Administration 50.523
- \* Administration 50.524
- \* Administration 50.530
- \* Administration 50.536
- \* Administration 50.551
- \* Administration 50.552
- \* Administration 50.563
- \* Administration 50.567
- \* Administration 50.568

No more than three of the courses may be selected from Administration 50.504, 50.510, 50.511, 50.524 and 50.563.

### *Development Concentration*

#### *5.0 credits selected from:*

- \* Administration 50.501
- \* Administration 50.511
- \* Administration 50.517
- \* Administration 50.523
- \* Administration 50.524
- \* Administration 50.530
- \* Administration 50.551
- \* Administration 50.552
- \* Administration 50.563
- \* Administration 50.568
- \* Administration 50.588
- \* International Affairs 46.507

\* International Affairs 46.508

\* International Affairs 46.537

No more than three of the courses may be selected from Administration 50.511, 50.517, 50.524, 50.552, and 50.588.

### *Innovation, Science and Environment Concentration*

#### *5.0 credits selected from:*

- \* Administration 50.501
- \* Administration 50.502
- \* Administration 50.508
- \* Administration 50.523
- \* Administration 50.530
- \* Administration 50.540
- \* Administration 50.541
- \* Administration 50.543
- \* Administration 50.544
- \* Administration 50.551
- \* Administration 50.552
- \* Administration 50.560
- \* Administration 50.567
- \* Administration 50.568
- \* Administration 50.587
- \* One of Business 42.570 or 42.571

No more than two of the courses may be selected from Administration 50.502, 50.508, 50.565, 50.501, and 50.587

## **Academic Standing**

All candidates are required to obtain a grade of B- or better in each course in the program. A candidate may, with the recommendation of the School and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed one grade of C+.

## **Doctor of Philosophy**

The doctoral program in public policy has two primary objectives:

- \* to contribute to the advancement of research and teaching based on one or more of the various approaches to the political economy of public policy (in OECD countries)
- \* to develop scholars and researchers for positions in universities, private research institutions, and various other public and private organizations

While the School's M.A. degree outlined above offers exposure to both policy and management, the Ph.D. focuses directly on the study of public policy from both Canadian and comparative perspectives. The formation and evolution of policy in Canada is a primary focus of the program. In addition, Canadian, European, and other international students interested in research with a European-Canadian and North American comparative perspective will also find the program conducive to their work in the fields of specialization offered. Areas of research specialization within the School include: policy institutions and instruments, industrial policy, and social and labour market policy.

A distinguishing feature of the School of Public Administration is the presence of faculty who strive to integrate political science and economics in their research and teaching. The Ph.D. program is to a considerable extent based on the view that political economy is essential to an understanding of the public sector. It is also based on the view that analyses of what governments do must address the interplay among the various policy fields, instruments, and institutions.

### **Degree Schedule**

The program consists of three academic terms of course work plus Preparation and completion of one comprehensive examination, as well as a doctoral thesis. The Ph.D. program in Public Policy normally will be undertaken on a full-time basis; however, in cases of exceptional merit, the School may accept a few candidates for the degree on a part-time basis.

### **Admission Requirements**

Admission will be judged primarily on the applicant's ability to conduct advanced research and to complete the program successfully. Applications should contain at least one essay or paper at the M.A. level written by the applicant. Enrollment is limited and possession of the minimum requirements does not, in itself, guarantee acceptance. To be eligible for financial assistance, application for admission for the fall term must be completed no later than March 1.

Admission requires completion of an M.A. degree in any of public administration, political science, economics, political economy, business administration, law, or similar degree with first class standing (4+ average or better in their M.A. work).

Students are advised that a working knowledge of basic calculus is required for completion of the program. Assistance in acquir-

ing these skills is provided by the program. Students requiring additional assistance should consult the Ph.D. co-ordinator.

Applicants must also successfully complete prerequisites in statistics, political science, and economics as described in detail below. These prerequisites may be satisfied by the completion of appropriate course work at the intermediate undergraduate level or higher in each of the subjects listed.

Completed statistics courses should be approximately equivalent to Administration 50.552 described under Master of Arts, p. 306. Candidates may, with permission of the School, satisfy the statistics prerequisite by completing this course with at least B+ standing concurrently with the Ph.D. program.

Prerequisites in political science and economics must be completed prior to entry. Completed courses in political science should be approximately equivalent to Administration 50.567 and Administration 50.568, while completed courses in economics should be approximately equivalent to Administration 50.523. This course is usually offered at the School in the summer term and equivalent courses may be taken at most universities throughout the academic year. Applicants should seek advice from the supervisor of the Ph.D. program about whether particular courses are acceptable as prerequisites.

### **Advanced Standing**

Advanced standing will not normally be granted for any of the required courses described below. If granted, advanced standing will be limited to 1.0 credit.

### **Program Requirements**

The program consists of the following elements:

- \* 4.5 credits of course work
- \* Preparation for and writing of one comprehensive examination, normally written in August of the first year
- \* Public defence of a written thesis proposal
- \* A thesis equivalent to 4.5 credits
- \* A language requirement

### **Course Component**

Courses will normally be taken in the First year, and the fall of the Second year. Students in the doctoral program are required to complete the following:



\* Six 0.5 credits; Administration 50.604, 50.605, 50.606, 50.607, 50.608, 50.609. A GPA of 9.0 (B+) or better overall must be obtained in these courses before proceeding to the comprehensive examination.

\* Administration 50.610

\* 1.0 credit that constitutes one area of specialization beyond the public policy foundations covered in the core courses. These courses will be chosen by the student after consultation with, and approval by, the student's academic supervisor and the Ph.D. coordinator

These courses will normally be graduate courses offered by the School or by the Departments of Political Science and Economics, or directed studies (50.691 and 50.692). However, other courses may be approved. Doctoral students taking courses at the master's level will be subject to enhanced course requirements. When necessary, students must arrange formal approval from the relevant department for admission to courses.

A GPA of 9.0 (B+) or better must be obtained in the above courses before proceeding to the comprehensive examinations.

### Comprehensive Examinations

Students will write a general comprehensive examination, normally in August of the First year. This examination will focus primarily on material emanating from the required first year courses.

Preparation for the comprehensive examination will be assisted through a tutorial as described below.

### Thesis

Following the successful completion of the comprehensive examinations, students will prepare a formal thesis proposal under a committee composed of the supervisor and two other faculty members. The thesis supervisor will normally be a faculty member from the School of Public Administration. Each committee must consist of at least one political scientist and one economist. The thesis must demonstrate an advanced ability to integrate the politics and economics of public policy. The thesis must be defended at an oral examination.

### Language Requirement

A reading knowledge of French will be required according to normal university Ph.D. language examination procedures. Another language may be substituted for French if it is essential for the thesis.

## Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

### Required Courses - M.A.

Administration 50.500F1

#### Public-Sector Management and the Canadian Political System

An examination of the principles and processes of public sector management as it functions through the institutions of cabinet-parliamentary government. Both institutional reforms and changes in the philosophy of public sector management are examined in the Canadian federal government and in a comparative context.

Administration 50.501F1

#### The International Policy Framework

An examination of the international initiatives and rules within which national development policies are developed and implemented.

Administration 50.502F1

#### The Political Economy of Regulation

An examination of political, economic, legal, and organizational theories of regulation in the Canadian and comparative context, and of the processes and consequences of regulatory practice in selected Canadian public policy fields.

Prerequisite: Administration 50.568.

Administration 50.504W1

#### Implementation, Service Delivery, and Compliance

An examination of the theory and practice of policy implementation, service delivery, and compliance in relation to Canadians as citizens and customers.

Administration 50.508W1

#### Environmental Policy

An examination of Canadian environmental policies and programs set in a comparative political-economic and institutional context.

Administration 50.510F1, W1

#### Management Accounting

An introduction to the principles and concepts of financial and management accounting. It includes illustrations of how accounting data can assist in the decision-making process.

ess of private and public organizations, and the limitations of that data.

Administration 50.511F1, W1

**Financial Management**

An introduction to several concepts and techniques relevant to defining long term funds (debt and equity), and to comparing alternative uses of those funds (NPV and IRR). Other topics include: financial ratios; pension management; and exchange rate determination.

Administration 50.517W1

**Project Management**

An examination of the managerial, organizational and financial issues and processes involved in the development and implementation of development projects.

Administration 50.522W1

**Macroeconomics for Management and Policy**

This course presumes an introductory knowledge of macroeconomics (subjects such as aggregate supply and demand, and concepts such as the multiplier). It considers contemporary macroeconomic issues (including the feasibility of active short-run stabilization policy, the determinants of long-run growth, the causes and effects of deficits and debt) and the conceptual frameworks available to analyze these issues.

Administration 50.523F1

**Microeconomics for Management and Policy**

This course presumes an introductory knowledge of microeconomics (subjects such as the competitive model and concepts such as elasticity). It considers consumer and producer theory, and certain exceptions to the competitive model that are particularly relevant to public policy (including externalities, public goods, imperfect competition).

Administration 50.524F1

**Applied Microeconomic Policy Analysis**

An examination of how microeconomic theory can be applied to analyze actual public policy problems and issues.

Prerequisite: Administration 50.523.

Administration 50.530F1, W1

**Organization Theory**

An introduction to, and critical discussion of, the major theoretical approaches to the study of organizations, including bureaucratic theory, scientific management, human relations, class theory and gender theory. It also addresses developments such as technology and organization, total quality management, empowerment and democratization strategies, and quality of working life.

Prerequisite: Administration 50.500 or the equivalent.

Administration 50.531

**Co-operative Work Term**

Prerequisites: Registration in the Co-operative Education Option of the Master of Arts program and permission of the School.

Administration 50.532

**Co-operative Work Term**

Prerequisites: Registration in the Co-operative Education Option of the Master of Arts program and permission of the School.

Administration 50.533

**Co-operative Work Term**

Prerequisites: Registration in the Co-operative Education Option of the Master of Arts program and permission of the School.

Administration 50.536F1, W1

**Law of Public Authorities I**

An examination of the legal environment of Canadian public administration, focusing on Canadian law, institutions and processes. It provides an introduction to Canadian legal history, adversarial adjudicative procedure and its alternatives, the legal limits on delegating power to public authorities, and considers in greater detail criminal prohibition and licensing as techniques of influencing behaviour, procedural justice in government decision making, and judicial and non-judicial controls on public authorities including the enforcement of ethics.

Administration 50.540F1 or W1

**Science and Technology Policies**

An examination of theory and practice regarding governmental policies for science and technology, and regarding the use of scientific or objective knowledge in the policy and regulatory processes of government. The course examines concerns regarding the ethical issues and the transparency of science in government.

Administration 50.541F1 or W1

**Technology, Firms and Systems of Innovation**

An examination of broad theories of the political economy of technological change. Such theories include those informed by neo-classical economics, recent evolutionary economic and institutionally oriented innovation studies.

Administration 50.543F1 or W1

**Science, Risk and Evaluation**

An examination of risk-benefit theories and practices and related issues in the evaluation of science and technology; including how they are handled in applied regulatory and policy institutions in selected sectors (e.g. Pesticides; health protection; biotechnology).

Administration 50.544F1 or W1

**The Nature of Science**

An examination for non-scientists of key ideas and concepts of science crucial to understanding science as an intellectual activity and experimental process. Ideas and concepts are linked to key areas where policy must have a scientific underpinning (e.g. Eco-systems, energy and resources, biotechnology, biodiversity and radiation).

Administration 50.551F1

**Quantitative Methods I**

An introduction to: descriptive statistics which are used to summarize information; probability theory and sampling distributions, which permit researchers to make valid predictions about population parameters from sample statistics; and the testing of hypotheses about quantitative and qualitative population parameters.

Administration 50.552F1, W1

**Quantitative Methods II**

The use of correlation and regression analyses to test hypotheses about the relationships between social-economic variables. The course covers simple-linear and multiple regression techniques, the underlying assumptions of ordinary least squares regression, and what can be done when some of these assumptions are violated.

Prerequisite: Administration 50.551.

Administration 50.560F1 or W1

**Sustainable Development and Industrial and Innovation Policy**

An examination of sustainable development ideas and ethics and their links to Canadian and comparative industrial and innovation policies including policies that affect: Research & Development incentives, intellectual property, trade and competition, and the knowledge-based services delivered by government to business and consumers.

Administration 50.563F1, W1

**Qualitative Research in Public Organizations**

The course deals with the specification and formulation of research problems, and with the design and conduct of qualitative social research in public sector settings. There is emphasis on tactics to control and summarize information throughout the life of a study, and on techniques for the reduction and presentation of non-quantitative data. Writing and communication skills are stressed. The skills gained are relevant to a number of kinds of analysis typically conducted in bureaucracies, such as program evaluation designs and studies, and implementation analysis.

Prerequisite: Administration 50.562.

Administration 50.567F1, W1

**Political Economy of the State**

An examination of theories of the modern state, drawing on different political economy traditions (for example, liberal, institutional, marxist, feminist). It provides an understanding of the central debates on the proper role of government that have shaped the state in the past, and that are currently shaping it for the future.

Administration 50.568F1, W1

**Policy and Decision Making**

An examination of policy analysis: the means whereby policy issues or problems are defined and their solutions designed, implemented and evaluated. It takes into account the formal institutional structures and processes of policy formulation and implementation, as well as theoretical issues concerning how policy is grounded in an understanding of the state, democracy and citizenship.

Prerequisites: Administration 50.500 or the equivalent and 50.567.

Administration 50.587W1

**Trade Policy**

An examination of Canadian multilateral and regional trade policies and programs set in a comparative political-economic and institutional context.

Administration 50.588F1

**Structural Adjustment Policy**

An examination of structural adjustment policies and programs with a comparative focus on developing countries, but also including their relations with developed countries.

International Affairs 46.507F1

**Theories of Development and Underdevelopment**

A comparative analysis of approaches to the study of development processes and underdevelopment, including structural-functional, neo-classical, Marxist, and dependency theories.

International Affairs 46.508W1

**Development Planning: Theory and Practice**

Third World development plans and strategies and their impacts; techniques employed in development planning, including social cost-benefit analysis, budgeting, and problems in development administration.

International Affairs 46.537W1

**Macroeconomics in a Development Context**

An examination of macroeconomic theory and policy in the context of the developing countries, with special emphasis upon theory and policy for open economies, structural



adjustment to international disequilibrium, exchange rate and balance of payments management, fiscal and financial policy.

### Optional Courses - M.A.

*Note:* Optional courses may only be taken when the student has completed at least nine required 0.5 credits or has obtained advanced standing in same.

Administration 50.503F1 or W1

#### **Policy and Administration in Intergovernmental Relations**

An examination of the major cost-sharing and fiscal transfer agreements, and the intergovernmental mechanisms for policy and administrative coordination in selected policy fields.

Administration 50.506F1

#### **Social Movements, Interests and the Policy Process**

An examination of the roles of social movements and interests in the policy process in a Canadian and comparative context.

Administration 50.507T2

#### **Comparative Research on Policy and Policy Management**

An examination of methodologies and issues of comparative research on policy and public management among and between developed and developing countries.

Administration 50.509F1

#### **Health Policy**

An examination of Canadian health policies and programs set in a comparative political-economic and institutional context.

Administration 50.513F1

#### **Budget Decision Making and Budgeting**

A study of selected aspects of the expenditure and revenue budget and budgetary process at all levels of government. Student papers are oriented towards critical review of actual budgets and budgetary processes.

Prerequisites: Administration 50.523 and 50.568.

Administration 50.515F1

#### **Management in the Public Service**

An examination through cases and research of selected problems and issues in public service management. The specific focus of the course will change each year; some topics include human resources management, government investment, and pricing decisions.

Administration 50.516W1

#### **Urban and Local Government Management**

An analysis of the principal issues and processes of Canadian urban and local government management and administration.

Administration 50.517W1

#### **Project Management**

An examination of the managerial, organizational and financial issues and processes involved in the development and implementation of development projects.

Administration 50.519W1

#### **Management in the Para-Public Sector**

An examination of managerial theory and practice in the para-public sector including voluntary organizations, interest groups, state-owned and mixed enterprises, and partnership arrangements.

Administration 50.520F1

#### **Public-Sector Investment and Pricing**

An examination of theory and practice related to decision making about public-sector investment and pricing policy, particularly in connection with large-scale projects and programs. The focus is applied cost-benefit analysis (discount rates, marginal cost and shadow pricing, and the handling of risk and uncertainty) in large-scale public investment choices. Prerequisite: Administration 50.523.

Administration 50.525F1

#### **The Canadian Economy**

This course examines, in an integrated fashion, the economy of Canada, the history of Canadian economic policy, and major current economic policy debates. The central thrust of the course is to present the view of the Canadian economy as a system, stressing linkages among sectors and the consequences for economic (and social) policy. The central theme will be explored, in part, by focusing on selected topics and issues such as industrial structure, regionalism, federalism, trade policy, stabilization and the deficit debate, labour markets, and income redistribution.

Prerequisites: Administration 50.522 and 50.523.

Administration 50.528F1, W1

#### **Management Information Systems**

An examination of the fundamentals of MIS: the nature of systems, information, and management processes, including concepts of data-processing technology, systems design, organizational impacts of information systems, and hardware and software considerations.

Administration 50.537F1

#### **Law of Public Authorities II**

An examination of characteristics and selected problems of control of administrative action. Topics include: varieties of traditional and constitutional, legal and judicial control, impact of the Charter, reforms to administrative law control systems in Canada, and comparisons with developments outside Canada.

Prerequisite: Administration 50.536.

Administration 50.538W1

**The Management of Provincial Government**

A comparative analysis of public-sector management structures and processes at the provincial level of government. Topics examined include personnel and financial systems, regional administration, public utilities, direct interprovincial program and project management, and international activities of provinces. Prerequisite: Administration 50.500 or the equivalent.

Administration 50.559W1

**Tax Policy**

An examination of Canadian tax policies set in a comparative political-economic and institutional context.

Administration 50.562F1, W1

**Planning and Evaluation in Government I**

An examination of selected concepts, issues, and processes in applied governmental planning and evaluation, utilizing both Canadian and comparative experiences.

Administration 50.564F1

**Social Policy**

A seminar which will study the nature and historical development of social programs and the welfare state in capitalist countries, with particular focus on Canada. The course will concentrate on developing a critical understanding of the social forces shaping these programs and evaluating the implications of current debate on the future of social policy in Canada.

Administration 50.569W1

**Economic Models of Politics**

An introduction to the application of microeconomic conceptual frameworks to political processes. Topics may include: types of market failure; interest group formation; collective choice mechanisms; the influence of legislative institutions on policy outcomes; principal-agent relationships and the bureaucracy.

Prerequisite: Administration 50.523.

Administration 50.570T2

**Policy Seminar**

An examination of one or more selected policy areas. The focus will be an analytical assessment of the selected policy area in terms of its many-sided economic, political, social, legal, quantitative, and administrative complexities. The policy field will change each year.

Administration 50.571F1, W1

**Gender and Public Policy**

An examination of policy and policy making as they pertain to gender relations within the state as well as in society at large. The course looks at the negative and positive effects of

public policy on gender relations in the family and the labour market.

Administration 50.572F1, W1, 50.573S1

**Policy Seminars**

An examination of one or more selected policy areas. The focus will be an analytical assessment of the selected policy area in terms of its many-sided economic, political, social, legal, quantitative, and administrative complexities. The policy field will change each year.

Administration 50.574F1

**Regional Policy**

This seminar examines the theory and practice of regional policy, using the Canadian experience as a case study. It begins with an analysis of regionalism and regional economic concerns. Then the alternative policy approaches that are available and their theoretical underpinnings are considered, and a critical review of Canadian efforts is undertaken. Particular emphasis is placed on the way in which federalism shapes perceptions of regional issues, and influences the approach to solutions. Regional development concerns in the Third World countries may be analyzed in brief if students from that region participate.

Administration 50.575F1

**Advanced Statistical Policy Analysis**

An examination of econometric research on selected policy issues. The issues considered vary each year and the analysis incorporates the study of selected econometric techniques. The course enables students to evaluate critically applied econometric studies of public policy.

Administration 50.581W1

**Human Resources Management**

An introduction to the field of human resources Management including the roles of human resource departments, employee motivation, staffing, compensation, benefits, training and development and employee relations.

Administration 50.584F1

**Industrial Relations and Public Sector Collective Bargaining**

An analysis of the basic concepts of industrial relations, with respect to both public- and private-sector employees and organizations.

Administration 50.586F1

**Aboriginal Policy**

An examination of Canadian policies and programs on aboriginal peoples and aboriginal peoples own policies as nations set in a comparative political-economic and institutional context.

Administration 50.589W1

### **Education Policy**

An examination of Canadian policies and programs on education set in a comparative political-economic and institutional context.

Administration 50.590T2

### **Directed Studies**

A tutorial or directed reading course on selected subjects.

Administration 50.591F1, W1, S1

### **Directed Studies**

A tutorial or directed reading course on selected subjects.

Administration 50.592F1, W1, S1

### **Directed Studies**

A tutorial or directed reading course on selected subjects.

Administration 50.593F1, W1, S1

### **Directed Studies**

A tutorial or directed reading course on selected subjects.

Administration 50.597T2

### **Special Project in Development Administration**

Administration 50.598F2, W2, S2

### **Research Essay**

Administration 50.599F4, W4, S4

### **M.A. Thesis**

## **Required Courses - Ph.D.**

*Note:* All courses are 0.5 credit (one-term) courses unless otherwise indicated. Ph.D. courses are open to master's students with approval of the School.

Administration 50.604F1

### **Policy Fields, Instruments and Institutions I**

An examination of comparative and Canadian theories and analyses of policy fields, instruments and institutions, with emphasis on selected fields (including social, labour market and industrial policy) and instruments (including public expenditure, taxation and regulation.)

Precludes additional credit for Administration 50.600.

Administration 50.605W1

### **Policy Fields, Instruments and Institutions II**

An examination of different approaches to understanding the roles of ideas, interests, and institutions in the policy process from a political science perspective. Topics may include discourse coalitions, policy learning, neo-institutionalism, policy communities, citizenship, community and contemporary challenges

to democratic government.

Precludes additional credit for Administration 50.600.

Administration 50.606F1

### **The Political Economy of Public Policy I**

An examination of various structural approaches to the political economy of public policy, including institutional, marxist, and other broad frameworks. Emphasis is placed on the contribution of these approaches to our understanding of social and economic changes and the role of public policy in shaping them.

Precludes additional credit for Administration 50.601.

Administration 50.607W1

### **The Political Economy of Public Policy II**

An examination of the microanalytic foundations of the political economy of public policy, with application to selected policy issues. Topics covered may include welfare economics and public goods, group formation, collective choice mechanisms, voting behaviour, the evolution of institutions and norms, principal-agent problems, and bureaucracy.

Precludes additional credit for Administration 50.601.

Administration 50.608F1

### **Economics of Public Policy I**

An examination of advanced topics in micro-economic theory, including consumption, production and industrial organization, with application to selected policy issues.

Precludes additional credit for Administration 50.602.

Administration 50.609W1

### **Economics of Public Policy II**

Selected application of economic theory to various contemporary public policy problems and issues. Topics chosen for study will vary from year to year. Emphasis is placed on the presentation by students of critical analyses of relevant literature.

Precludes additional credit for Administration 50.602.

Administration 50.610F1, W1, S1

### **Public Policy Research**

An examination through analyses of selected current research projects of basic applied research issues, philosophies, and problems in public policy research.

Precludes additional credit for Administration 50.603.

Administration 50.690F2, W2, S2

### **Ph.D. Tutorial**

A tutorial specifically designed as preparation for the general comprehensive examination, under the direction of two or more faculty



members. The grade to be awarded will be that obtained on the general written examination.

Administration 50.691 F1, W1, S1

### **Ph.D. Specialization Tutorial**

A Ph.D. tutorial covering advanced theory and research in an area of specialization generally related to public policy. Specific topics will be selected in consultation with, and must be approved by, the academic supervisor and Ph.D. co-ordinator.

Administration 50.692 F1, W1, S1

### **Ph.D. Specialization Tutorial**

A Ph.D. tutorial covering advanced theory and research in an area of specialization generally related to public policy. Specific topics will be selected in consultation with, and must be approved by, the academic supervisor and Ph.D. co-ordinator.

Administration 50.699 F10, W10, S10

### **Ph.D. Thesis**

Students will normally be supervised by faculty in the School of Public Administration but may also seek supervision from faculty in other social science departments, schools, and institutes.

## Religion

Dunton Tower 2121  
Telephone: 520-2100

### The Program

**Coordinator and Supervisor of Graduate Studies, J.G. Ramisch**

The Religion program offers studies leading to the Master of Arts.

### Master of Arts

#### Admission Requirements

The minimum requirement for admission to the master's program is an Honours bachelor's degree in religion (or the equivalent) with at least high honours standing.

Applicants who do not hold an Honours degree in religion (or the equivalent) will be required to register in a qualifying-year program before proceeding to the master's program.

The regulations governing the qualifying year are outlined in the General Regulations section of this Calendar.

#### Program Requirements

Students are required to complete 5.0 credits as follows:

- \* Religion 34.500
- \* 34.501
- \* 34.502
- \* 34.503
- \* 34.599

34.501 and 34.502 must be taken in two different areas other than the student's thesis area. Seminars in other units may be substituted for 34.501 and 34.502 with permission of the department. The department particularly encourages students to consider Anthropology 54.543 (also listed as Religion 34.543) as a substitute for 34.501 or 34.502 if anthropology of religion is not their thesis area.

The student's program will be worked out in consultation with, and with the approval of, the department's supervisor of graduate studies and its committee on graduate studies. The prescribed program will take into account the student's background and special interests, as well as the research interests and competence of the staff.

### Deadlines

#### *Thesis Proposal*

Full-time students will normally submit their thesis proposal to the thesis proposal board by the end of the first month of their second term in the master's program.

#### *Thesis*

Regulations governing requirements for the master's thesis, including deadlines for submission, are outlined in the General Regulations section of this Calendar, Section 12.

### Guidelines for Completion of Master's Degree

Full-time students in the master's program are normally expected to complete all requirements within two years of entry into the program. Part-time students normally complete all requirements within five years of the date of entry into the program.

### Language Requirements

The student will be required to acquire, or to demonstrate that he/she already has, a reading knowledge of whatever language is essential to his/her research. Students are advised to consult the Supervisor of Graduate Studies for further regulations.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Religion 34.500T2

#### **Graduate Seminar in Religion**

A seminar on theories and methods in the study of Religion. Compulsory for M.A. students.

Religion 34.501F1, W1, S1

#### **Directed Studies in Religion**

Religion 34.502F1, W1, S1

#### **Directed Studies in Religion**

Religion 34.503T2, S2

#### **Tutorial**

A tutorial preparing the student in the general area of their thesis. Normally taken with the thesis supervisor.

## Religion

Religion 34.543F1 or W1

### **The Anthropology of Signs and Symbols**

This course will examine various theoretical and methodological approaches to the anthropology of signs and symbols, their internal workings, and their relationship to other aspects of social life. These approaches may include structural and post-structural semiotics, psychoanalysis, feminism, critical anthropology, neuroanthropology, hermeneutics, and phenomenology. Discussions are grounded through illustrative analyses of concrete case studies and exemplary cases of possible interpretive strategies. (Also listed as Anthropology 54.543)

Prerequisite: Permission of the Department.

Religion 34.599F4, W4, S4

**M.A. Thesis**



## Social Work

Dunton Tower 509  
Telephone: 520-5601  
Fax: 520-7496

### The School

**Director of the School,** To be announced  
**Supervisor of Graduate Studies,** Roy Hanes

The School of Social Work, accredited by the Canadian Association of Schools of Social Work, offers a graduate program leading to the degree of Master of Social Work. Year I will normally be completed over two terms of full-time study. Year II will normally be completed over three terms or twelve months of full-time study. Part-time study is also offered. Year I will normally be completed over two to three years, and Year II will normally be completed over three to four years.

### Master of Social Work

The Master of Social Work program is based on an analytical and critical approach to social work practice, and to knowledge related to practice. The program examines the structural context of personal and social problems and of social work practice itself. The structural context refers to the interaction between individuals and the social, political, and economic dimensions of society. The program focuses on the development of social work practices that change the interactions between people and structural contexts. The curriculum is organized into three concentrations representing the foundations of social work practice: Direct Intervention with Individuals, Families and Small Groups; Social Administration and Policy; and Community Work and Social Development.

The orientation of the School explicitly includes approaches to social policy development and social change that involve working collaboratively with individuals, groups, and communities. Strong emphasis is placed on sensitivity to the individual, and on the development of new and innovative strategies for working with individuals in the context of their everyday lives. The School also stresses community work and social development that raises awareness of social problems that affect the lives of all people in our society. Analysis of the material conditions of life in Canadian society and the production of class, gender, and race is considered central to all aspects of the curriculum.

The School of Social Work is committed to educational equity. The society in which we live and of which social work is a constituent part is composed of groups of people distinguished by their differential access to power - economic, political, and social. The School affirms the principle that all these groups should have the opportunity to learn in a supportive environment. Educational equity is consistent with a continuing commitment to meeting high standards of academic and practice competence.

The central purpose of the graduate program is to provide students with the opportunity to build on their knowledge and experience. Students will be able to use the program to deepen their understanding of both the methods and contexts of practice, to build new knowledge, and to apply this new knowledge in a practical way. The program requirements are designed to be as flexible as possible while at the same time ensuring that all students master core social work knowledge and practice skills. Graduates may expect to use their experience in the School as the basis for continuing to expand their personal knowledge in a society undergoing rapid change.

### Admission Requirements

The School of Social Work provides two points of entry into the Master of Social Work program.

Applications are accepted to the first year of a two year M.S.W. program from candidates who hold an Honours bachelor's degree, or the equivalent, with at least high honours standing (normally B+ or better in honours subject; B- or better overall) in a discipline other than social work.

Applications are accepted to the one year M.S.W. program from candidates who hold an accredited Bachelor of Social Work degree with honours standing (normally B+ or better in honours subject; B- or better overall).

Applications are accepted to the one year M.S.W. program from candidates who are in the final year of a Bachelor of Social Work program, and who have maintained a B+ or better in social work and B- or better overall. Applicants with social work experience who hold undergraduate or graduate applied social science degrees from a university or other degree granting institution are directed to apply to the two year M.S.W. program. The School will review the equivalence of such degrees to a Bachelor of Social Work.

Work experience in social work or a related field is considered as one of several selection

criteria for both M.S.W. Year I and M.S.W. Year II.

Persons who have a Bachelor of Arts degree and human service experience may also wish to apply to the Bachelor of Social Work program. Please refer to the *Undergraduate Calendar* for further information.

Applicants must have completed 1.0 credit in research methods in their undergraduate program. The School of Social Work will not normally grant advanced standing for course work completed prior to entry into the M.S.W. program. Students accepted into M.S.W. Year I will be expected to complete 5.0 credits of course work in Year I and 6.0 credits of course work in Year II. Students accepted into M.S.W. Year II will be expected to complete 6.0 credits of course work. Work experience may not be substituted for research or other academic requirements, including the practicum.

Candidates must apply by February 1 for September admission.

### Part-Time Studies

The School offers part-time studies to a limited number of qualified candidates who cannot participate in a program of full-time study. The requirements for part-time studies are identical to those of the regular program except that part-time students are limited to a maximum of 1.0 credit of course work per term.

Students registered on a part-time basis must maintain continuous registration for a minimum of two terms per year until all course requirements are completed.

In their first fall term, part-time students in the M.S.W. Year I must register in Social Work 52.551 or 52.552 and one of 52.538, 52.548, or 52.568. Part-time students in the M.S.W. year II register in social work 52.535 plus an additional 0.5 credit of course work in their first fall term.

### Change of Status

Students contemplating changing their full-time or part-time status should consult the General Regulations section of the Graduate Calendar (see p. 55.)

### Program Requirements

Students with an Honours undergraduate degree other than a B.S.W. or the equivalent who are admitted into the two-year M.S.W. program must complete Year I and Year II.

Students with a B.S.W. or equivalent who are admitted into the one-year M.S.W. program

must complete Year II.

Year I of the M.S.W. consists of the following 5.0 credits:

\* 52.538F1 or W1

\* 52.548F1 or W1

\* 52.568F1 or W1

\* 52.551F1 or W1

\* 52.552F1 or W1

\* 52.566F4 or W4 or S4

\* 0.5 credit to be taken from graduate-level course offerings in the School.

Year II of the M.S.W. consists of the following 6.0 credits:

\* 52.535 (or 52.536 and 52.537)

\* 52.545 (or 54.546 and 52.547)

Any two of the following:

\* 2.0 credits of course work to be chosen in consultation with the student's faculty advisor. Of the electives, a minimum of 1.0 credit must be taken from graduate-level course offerings in the School of Social Work, a maximum of 1.0 credit may be taken outside the School of Social Work, and a maximum of 0.5 credit may be taken at the 400-level.

\* 52.599 (2.0 credits)

\* 52.567 (2.0 credits), or 52.565 (2.0 credits)

All students in Social Work 52.599, 52.566, 52.567, 52.565 must maintain continuous registration until completion of the course in accordance with the General Regulations as stated in this Calendar.

### Students in the Master's Program before 1995

The program requirements established on admission for students who were registered in the two-year M.S.W. program prior to 1995 continue to apply; however, negotiation of course offerings to satisfy program requirements will be established on an individual basis. Completion of a practicum and either a Thesis or an Independent Enquiry Project (Social Work 52.590) will continue to be required.

### Academic Standing

Candidates for the M.S.W. degree must complete all course work (or the equivalent) counted towards the degree with a grade of B- or better. The School of Social Work does not permit the C+ option.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

*Note:* All seminar courses, directed studies, workshops, independent study courses, and community practice courses are governed by Section 7.7, Tutorials, of the General Regulations.

### M.S.W. Year I - Required Courses

Social Work 52.538F1 or W1

#### Direct Intervention

Presentation of a structural framework for social work theory and practice examining assessment and interventive approaches, analytical and interaction skills, helping process and social transformation. Explores interventions with individuals, families, small groups based on an understanding of class, gender, race, age, ability and sexual orientation. Precludes additional credit for Social Work 52.534.

Prerequisite: Registration in M.S.W. Year I.

Social Work 52.548F1 or W1

#### Social Administration and Policy

Knowledge and skills required for understanding, analyzing and practicing social policy development and administration in social work. Political, economic, and social context of policy making, theoretical perspectives for developing policy, and contemporary social policy issues.

Precludes additional credit for Social Work 52.534.

Prerequisite: Registration in M.S.W. Year I.

Social Work 52.551F1 or W1

#### Theories in Social Science and Social Work

Examines relationships between theories in social science and in social work exploring connections to social work practice and emphasizing theories of inequality.

Precludes additional credit for Social Work 52.550.

Prerequisite: Registration in M.S.W. Year I.

Social Work 52.552F1

#### History of Social Welfare and Social Work

Historical development of social welfare policies and the Canadian welfare state. History of relationship of economy, family, welfare in-

stitutions and Canadian state. Focus on the origins and development of social work as a profession.

Precludes additional credit for Social Work 52.550.

Prerequisite: Registration in M.S.W. Year I.

Social Work 52.566F4,W4,S4

#### Practicum I

Integration of academic and practical aspects of social-work education. 500 hours of guided learning in a community-based setting. Field seminar required.

Prerequisite: Registration in M.S.W. Year I, and completion of or concurrent registration in Social Work 52.538, 52.548, 52.551, 52.552, and 52.568.

Social Work 52.568F1 or W1

#### Community Work

Models and methods of community organization. Social-economic contexts and ideological approaches to social change work; social change efforts; globalization and corporate rule.

### M.S.W. Year II - Required Courses and Program Options

Social Work 52.535T2

#### Advanced Theory for Social Work Practice

Advanced theory of the intersection of practice in direct intervention, community work, and social administration and policy, from a perspective of a range of structural inequalities.

Prerequisite: Registration in M.S.W. Year II.

Social Work 52.536F1

#### Advanced Social Work Practice

First half of 52.535T2.

Prerequisite: Registration in M.S.W. Year II.

Social Work 52.537W1

#### Advanced Social Work Practice

Second half of 52.535T2.

Prerequisite: Registration in M.S.W. Year II.

Social Work 52.539F1, W1, S1

#### Foundations of Direct Intervention

Philosophical and historical evolution of the competing paradigms underlying contemporary social work practice, with individuals, families, and community analyzed using philosophy of science and the sociology of knowledge.

Social Work 52.545T2

#### Research and Evaluation in Social Work

Research or evaluation projects in partnership with community agencies and practitioners.

Prerequisite: Registration in M.S.W. Year II.



## Social Work

Social Work 52.546F1

### **Research and Evaluation in Social Work**

First half of 52.545T2.

Prerequisite: Registration in M.S.W. Year II.

Social Work 52.547W1

### **Research and Evaluation in Social Work**

Second half of 52.545T2.

Prerequisite: Social Work 52.546.

Social Work 52.549W1

### **Social Administration and Policy**

Second half of 52.540T2.

Prerequisite: Registration in M.S.W. Year II.

Social Work 52.560F4,W4,S4

### **Practicum II**

500 hours integrating advanced social work theories and practice. Students are expected to build on and to develop beyond present knowledge and skills. Field seminar required. Not usually available in the first term of registration.

Prerequisites: Initial registration in the M.S.W. program in either 1995-96 or 1996-97.

Social Work 52.565F4,W4,S4

### **Community Practice Project**

Combines classroom instruction, social research, and community work practice. Students will develop and implement a community based project that addresses issues of social justice for those disadvantaged by social inequalities. This option will be offered subject to sufficient registration. Available full-time and part-time. Not usually available in the first term of registration.

Prerequisite: Registration in M.S.W. Year II, and completion or concurrent registration in Social Work 52.535.

Social Work 52.567F4,W4,S4

### **Practicum II**

500 hours integrating advanced social work theories and practice. Field seminar required. Not usually available in the first term of registration.

Prerequisite: B.S.W. or completion of M.S.W. Year I, and completion or concurrent registration in Social Work 52.535.

Social Work 52.599F4,W4,S4

### **Thesis**

Prerequisite: Registration in M.S.W. Year II.

## **Optional Courses**

Social Work 52.506F1 or W1 or S1

### **Social Work, Gender and the State**

This seminar course examines the construction of the "social" sphere and making the "social" work as it applies to the development of social welfare and the social work profession. An analysis of the gendered character of state provisions, women's participation in their

formation, and their implications with regard to race and class is used to examine the current restructuring of social welfare.

Social Work 52.511F1 or W1 or S1

### **Social Policy Analysis**

Conceptual, theoretical, and empirical tools for the analysis of social policies in Canadian society.

Social Work 52.512F1 or W1 or S1

### **Political Economy of Health**

Distinctions and connections between health and health care. Who receives care, who provides it, who pays for it, and who makes the decisions affecting it.

Social Work 52.515F1 or W1 or S1

### **Poverty and Income Security**

Examination of theories of poverty and wealth, conflicting understandings of poverty and the unequal distribution of income and wealth in Canada. Theories of poverty and wealth as they influence social policy, notably universal programs, social welfare services, income redistribution, and taxation.

Social Work 52.516F1 or W1 or S1

### **Women and Social Policy**

Structural analysis of social policy affecting women. Relationship of feminist scholarship to the practical work of developing policy and to policy outcomes for women. Impact of the women's movement on the formal processes of policy making.

Social Work 52.518F1 or W1 or S1

### **Seminar in Social Policy**

Social policy analysis of particular fields such as corrections, mental health services, children's services, or health care services. Current programs, historical developments, and the major current issues, developments, and challenges.

Social Work 52.527F1 or W1 or S1

### **Community Economic Development**

Critical understandings of sustainable Community Economic Development (CED). Diverse local and international CED initiatives. Skills necessary for facilitating CED processes.

Social Work 52.531F1 or W1 or S1

### **Women, Male Violence and Social Change**

Focus on male violence against women. Theory, responses of the state and the justice system, and practice approaches to helping women and the men who abuse them, as well as initiatives for social change.

Social Work 52.532F1 or W1 or S1

### **Mental Health Policy and Practice**

Historical development, legislative framework, institutional and service structure, and practice issues related to mental health services in Canada. The interface between mental health

and sexual abuse, family violence, racism, corrections, aging and immigration.

Social Work 52.553T2,F2,W2,S2

**Directed Studies - Group**

Exploration of selected theoretical perspectives relevant for social work practice that are offered subject to the availability of faculty. Arranged for small groups of students who are interested in a similar substantive area.

Social Work 52.554T2,F2,W2,S2

**Directed Studies - Individual**

Individual exploration of selected theoretical perspectives for social work practice under the direct supervision of a member of faculty or visiting scholar.

Social Work 52.555F1,W1,S1

**Directed Studies - Group**

Exploration of selected theoretical perspectives relevant for social work practice that are offered subject to the availability of faculty. Arranged for small groups of students who are interested in a similar substantive area.

Social Work 52.556F1,W1,S1

**Directed Studies - Individual**

Individual exploration of selected theoretical perspectives for social work practice under the direct supervision of a member of faculty or visiting scholar.

Social Work 52.557F1,W1,S1

**Workshop on Selected Topics in Social Work Practice**

Approved workshops organized in the School and in the community may be offered subject to the availability of faculty. Evaluation of students is based on the student's role in the workshop and the nature of the assignment(s) required of the student.

Social Work 52.558T2,F2,W2,S2

**Studies in Social Work**

May combine directed studies - group or individual - workshops, research study, or community practice. Registration is by permission of the supervisor of graduate studies and will be granted only when the student has negotiated an approved study agreement with the social work instructor(s).

Social Work 52.559F1,W1,S1

**Studies in Social Work**

May combine directed studies - group or individual - workshops, research study, or community practice. Registration is by permission of the supervisor of graduate studies and is granted only when the student has negotiated an approved study agreement with the social work instructor(s).

Social Work 52.569F1,W1,S1

**Studies in Community Practice**

May be offered subject to the availability of faculty. Studies are supervised by faculty. A written proposal is required that must include learning objectives, practice objectives, time of completion, and criteria and method of evaluation.

Social Work 52.570F1,W1,S1

**Special Topics in Social Work**

The School will offer lecture courses on substantive topics related to social work and social welfare. Topics will vary each year depending on the interests of faculty and students. Students from outside the School of Social Work may register with permission of the School.

Social Work 52.571F1,W1,S1

**Special Topics in Social Work**

The School will offer lecture courses on substantive topics related to social work and social welfare. Topics will vary each year depending on the interests of faculty and students. Students from outside the School of Social Work may register with permission of the School.

Social Work 52.572F1,W1,S1

**Special Topics in Social Work**

The School will offer lecture courses on substantive topics related to social work and social welfare. Topics will vary each year depending on the interests of faculty and students. Students from outside the School of Social Work may register with permission of the School.

Social Work 52.573F1,W1,S1

**Special Topics in Social Work**

The School will offer lecture courses on substantive topics related to social work and social welfare. Topics will vary each year depending on the interests of faculty and students. Students from outside the School of Social Work may register with permission of the School.

Social Work 52.574F1 or W1 or S1

**Race, Culture and Social Work Practice**

Anti-racist framework for social work practice to analyze policy and practice issues. "Privilege" as a critical and essential component for understanding oppression based on race and culture. Complex intersections of race and culture with class, gender, age, and other dimensions.

Social Work 52.575F1 or W1 or S1

**Child Protection Policies and Interventions**

Social organization of child protection policies, services, and interventions in Canada. Front-line child protection social work and

the relationship to organizational contexts, the forms of a legal apparatus, the rules for documentary production, and the effects of social power differentials.

Social Work 52.581F1 or W1 or S1

**Social Work Practice Seminar: Feminist Social Work Practice with Individuals, Couples, and Families**

Theory and practice of feminist approaches to social work with individuals, couples and families. Issues of diversity, such as race and class, as well as gender. Problem-based learning approach.

Social Work 52.582F1 or W1 or S1

**Social Work Practice Seminar: Cross-cultural Studies of the Self and Related Subjects**

Governance and care of the Self in different cultural and historical contexts. Theoretically located in emergent sociology and psychology of governance and care of the self. Cross-cultural perspectives practices and policies of different forms of governance and debates about social regulation.

Social Work 52.584F1 or W1 or S1

**Social Work Practice Seminar: Organizing for Social Change**

Hands-on introduction to theories, models, and methods of organizing for social change from grass roots groups to national coalitions. Practical skills for helping people mobilize to influence relevant social issues. Problem-based learning approach.

Social Work 52.585F1 or W1 or S1

**Social Work Practice Seminar: Social Development in the International Context**

International social development policies and practices from a cross-cultural perspective. Focus on international social policies and practices, and on economic, health, telecommunication, migration, and education policies and practices.

Social Work 52.583F1, W1, S1

**Social Work Practice Seminar**

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

Social Work 52.586F1, W1, S1

**Social Work Practice Seminar**

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

Social Work 52.587F1, W1, S1

**Social Work Practice Seminar**

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

Social Work 52.588F1, W1, S1

**Social Work Practice Seminar**

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

Social Work 52.589F1, W1, S1

**Social Work Practice Seminar**

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

Social Work 52.590F2, W2, S2

**Independent Enquiry Project**

This course is available only for those students registered in the previous two-year program.

(See 1993-94 *Graduate Calendar* or consult the School for description).

Social Work 52.592F4, W4, S4

**Thesis**

This course is available only for students completing a thesis under the previous two-year program.

Social Work 52.593T2, F2, W2, S2

**Independent Research Studies in Social Work**

Individually-arranged independent research study. Requires a written proposal that outlines a research project with clear learning objectives, and practice objectives (where relevant).

Social Work 52.594F1, W1, S1

**Independent Research Studies in Social Work**

Individually-arranged independent research study. Requires a written proposal that outlines a research project with clear learning objectives, and practice objectives (where relevant).



## Sociology and Anthropology

Loeb Building B742  
Telephone: 520-2582  
Fax: 520-4062

### The Department,

**Chair of the Department,** To be announced

**Coordinator of Graduate Programs in Sociology,** To be announced

**Coordinator of the Graduate Program in Anthropology,** To be announced

The Department of Sociology and Anthropology offers programs of advanced study and research leading to the M.A. and the Ph.D. degrees in Sociology, and the M.A. in Anthropology.

The principal focus of the graduate programs in sociology is the organization and development of contemporary societies in comparative context and with particular reference to Canadian society. Specializations in theory and methodology, social stratification and power, cultural and gender studies, and in comparative institutions are offered.

The anthropology program focuses on the social and cultural other, including its popular and scholarly representations, through current emphasis on three program concentrations:

- \* the anthropology of signs and symbols
- \* North American native studies
- \* the anthropology of development and underdevelopment.

The department strives to achieve a blend of research and formal graduate instruction in its graduate programs.

### Qualifying-Year Program

Applicants with general (3 year) bachelor's degrees may be admitted into a qualifying-year program designed to raise their standing to honours status. Students earning at least high honours standing in their qualifying-year courses will be considered for admission into the master's program.

Refer to the General Regulations section of this Calendar for details of the regulations governing the qualifying year.

## Master of Arts in Sociology

### Admission Requirements

The requirement for admission into the master's program is a B.A. (Honours) (or the equivalent) with at least high honours standing. Where relevant, previous professional experience will be taken into account in determining an applicant's standing on admission.

The deadlines for submitting applications and supporting documents for graduate study in sociology are as follows: February 1 for students requesting financial assistance; July 1 for students not requesting financial assistance but who are seeking admission in September; and

November 1 for students who are seeking admission in January.

### Program Requirements

Master's students in sociology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

#### *Thesis Program*

\* 3.0 credits including Sociology 53.505. Under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level. Sociology 53.589, is highly recommended, especially for students who at the time of registration have not decided on a thesis topic

\* A thesis equivalent to 2.0 credits

\* An oral examination on the candidate's thesis and program

#### *Research Essay Program*

\* 4.0 credits including Sociology 53.505. Under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level. Sociology 53.589, is highly recommended, especially for students who at the time of initial registration have not decided on a research topic

\* A research essay equivalent to 1.0 credit

\* An oral examination on the candidate's research essay and program

#### *Course Work Program*

\* 5.0 credits including Sociology 53.505, and excluding Sociology 53.595. Under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level

\* Written and oral comprehensive examination in the candidate's area of specialization and program

## Concentration in Quantitative Methodology

Students in either the research essay or thesis program options may pursue a concentration in quantitative methodology. For a concentration in quantitative methodology courses selected must include the following:

\* Sociology 53.505

\* Sociology 53.589

\* At least 1.0 credit selected from: Sociology 53.511; 53.512; 53.513; 53.514; 53.515; 53.521; 53.565

\* At least 1.0 credit in sociology at the graduate level (not including those listed above)

Students in the Concentration in Quantitative Methodology may apply for admission into a Cooperative Education option. This option provides an opportunity for students to enhance their educational experience through a work placement directly related to their area of interest and expertise. Once admitted into this option, students shall enroll in 53.597. The conditions of the placement are arranged with the student's supervisor and the graduate coordinator. Grades for the cooperative education placement are assigned in consultation between the placement supervisor and the graduate coordinator. Placements can be held for up to two academic terms and count for 1.0 credit.

## Transfer from Thesis to Course Work M.A.

Students who choose to change from the thesis to the course work program must normally do so before registering for a third term after initial, full-time registration, or before registering for a fifth term after initial part-time registration.

## Academic Standing

A grade of B- or better must normally be obtained in each credit counted toward the master's degree. With the recommendation of the department, and permission of the Dean of the Faculty of Graduate Studies and Research, a candidate may be allowed a grade of C+ in 1.0 credit.

## Master of Arts in Anthropology

### Admission Requirements

The requirement for admission into the master's program is a B.A.(Honours) (or the equivalent) with at least high honours standing. Where relevant, previous professional experience will

be taken into account in determining an applicant's standing on admission.

The deadlines for submitting applications and supporting documents for graduate study in anthropology are as follows: February 1 for students requesting financial assistance; July 1 for students not requesting financial assistance but who are seeking admission in September; and

November 1 for students who are seeking admission in January.

## Program Requirements

Master's students in anthropology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

### *Thesis Program*

3.0 credits to include:

\* Anthropology 54.541 (normally to be taken in the first fall term after admission to the program)

\* Anthropology 54.542

\* 2.0 additional credits selected from the anthropology graduate course offerings; from courses offered in the sociology graduate program (especially in theory and methods, or in areas which relate to the student's thesis research interests); from 400-level courses offered in the sociology and anthropology undergraduate program (with permission of the graduate committee); or any combination of these selected in consultation with the student's graduate adviser. Courses in other programs in the University may also be selected, especially if they relate to the student's proposed thesis research, but normally not in excess of 1.0 credit

\* A thesis equivalent to 2.0 credits

\* An oral examination on the candidate's thesis and program

### *Course Work Program*

5.0 credits excluding Anthropology 54.595, consisting of:

\* Anthropology 54.541 (normally to be taken in the first fall term after admission to the program)

\* Anthropology 54.542

\* 4.0 additional credits as described in the thesis program above, chosen in consultation with the student's graduate adviser

\* A written and oral comprehensive examination in the candidate's area of specialization and program

### Transfer from Thesis to Course Work M.A.

Students who choose to change from the thesis to the course work program must normally do so before registering for a third term after initial, full-time registration, or before registering for a fifth term after initial part-time registration.

### Academic Standing

A grade of B- or better must normally be obtained in each credit counted toward the master's degree. With the recommendation of the department, and permission of the Dean of the Faculty of Graduate Studies and Research, a candidate may be allowed a grade of C+ in 1.0 credit or each of two 0.5 credits.

### Doctor of Philosophy in Sociology

The substantive focus of the Ph.D. program is the organization and development of contemporary societies, both in a comparative context and with particular reference to Canadian society.

The Ph.D. program in sociology normally will be undertaken on a full-time basis; however in exceptional cases the department will consider admission on a part-time basis.

### Admission Requirements

The minimum requirement for admission into the Ph.D. program is a master's degree (or the equivalent) in sociology, normally with a minimum average of B+ in courses (including the thesis where applicable), and with no grade below B.

Applicants who have deficiencies in certain areas may be admitted to the Ph.D. program, but will normally be required to complete additional course work.

The deadlines for submitting applications and supporting documents for admission into the Ph.D. program in sociology are as follows: February 1 for students requesting financial assistance; July 1 for students not requesting financial assistance but who are seeking admission in September; and November 1 for students who are seeking admission in January.

### Program Requirements

The specific program requirements of the Department of Sociology and Anthropology are the following:

\* 10.0 credits including Sociology 53.600, and a thesis equivalent to a maximum of 7.0 credits or a minimum of 5.0 credits

- \* Written and oral comprehensive examinations in three areas of specialization
- \* Presentation of a thesis proposal
- \* Language requirements as stated below
- \* An oral defence of the thesis

### Comprehensive Examinations

Each Ph.D. candidate is required to write comprehensive examinations in three of the following areas:

- \* Theory and Methodology
- \* Stratification and Power
- \* Cultural Studies
- \* Comparative Institutions

At least one but not all three of the examinations must be in the area of stratification and power.

Subjects of instruction and research subsumed under these four areas are:

#### *Theory and Methodology*

- \* Logic of Social Scientific Enquiry
- \* Classical Social Theories
- \* Contemporary Social Theories
- \* Feminist Theories
- \* Research Methodology

#### *Stratification and Power*

- \* Occupations and Formal Organizations
- \* Class Analysis
- \* Labour Process
- \* Political Sociology
- \* Race and Ethnic Relations
- \* Gender Relations
- \* Social Stratification and Mobility

#### *Cultural Studies*

- \* Ideology, Religion
- \* Communication and Popular Cultures
- \* Socialization and Education
- \* Ethnographic Areas

- \* Discourse Analysis

#### *Comparative Institutions*

- \* Canadian Society
- \* Socio-linguistics
- \* Population Studies



## Sociology and Anthropology

- \* Social and Economic Development
- \* Deviance, Law, and Criminal Justice

Upon petition to the sociology graduate program's coordinator, an approved field in sociology or a related discipline may be substituted for one of the options above. The subjects of instruction and research subsumed under each of the areas are indicative, and may be subsumed under more than one area, depending on the analytic approach adopted.

The comprehensive examinations are to be completed after course requirements for the Ph.D. have been completed. Normally comprehensive examinations must be completed no later than two years or six terms after initial full-time registration, and four years or twelve terms after initial part-time registration.

The thesis proposal is to be presented after comprehensive requirements have been completed. Normally the thesis proposal must be presented no later than two and one-half years or seven terms after initial full-time registration and five years or fifteen terms after initial part-time registration.

### Language Requirement

The Department of Sociology and Anthropology requires each Ph.D. candidate to demonstrate an understanding of a language other than English. Although French is the preferred second language, students may be permitted to substitute another language if it is demonstrably relevant to their professional interests. It is strongly advised, however, that all English-speaking candidates be proficient in French. The language requirements may be satisfied by a demonstration of reasonable understanding, on sight, of material contained in selected samples of sociological literature in that language. Students may find it necessary or advisable to take a course in the required language before undertaking the departmental language examination.

### Academic Standing

Candidates must obtain a grade of B- or better in each credit, and *Satisfactory* on the comprehensive examinations, the Ph.D. thesis and its oral defence.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

#### Sociology 53.500F1 or W1 Classical Sociological Theory

The course focuses on crucial sociological concepts and ideas proposed by the founders of sociology. Particular attention will be given to the contributions of Marx, Weber, and Durkheim; plus others such as Pareto, Comte, and Husserl. These will be situated within the philosophical, epistemological and social changes brought about by industrialization.

#### Sociology 53.501F1 or W1 Selected Topics in Classical Theory

Topic varies from year to year. Students should check with the Department regarding the topic offered.

#### Sociology 53.502F1 or W1 Contemporary Sociological Theory

The seminar will provide an analysis of major theoretical perspectives in sociology, including social behaviourism; social action theories such as symbolic interactionism, phenomenological sociology, ethnomethodology; and structuralist theories such as structural functionalism, neo-Marxism and critical theory. The seminar will focus on certain methodological and philosophical issues relevant to the analysis of the perspectives.

#### Sociology 53.503F1 or W1 Selected Topics in Contemporary Theory

Topic varies from year to year. Students should check with the Department regarding the topic offered.

#### Anthropology 54.504F1 or W1 Ecological Anthropology

This course examines anthropological approaches to the study of human environment relationships and to current problems of ecological degradation affecting native societies around the world. Topics covered include the influence in anthropology of ecological models borrowed from biological evolutionary theory and studies of non-human species. The implications of ecological analyses for the making of environmental policies will also be considered.

#### Sociology 53.505F1 Recurring Debates in Social Thought

An opportunity for M.A. students in sociology to consider recurring issues and debates in the discipline. Topics such as the nature of social science; the objective world versus social construction; questions of evidence, mean-

ing and measurement; agency versus structure; the relation between research and praxis; knowledge and power, may be considered. This course is required for all master's students in sociology. It should normally be taken in the first term of registration in the master's program. Students entering the program in the winter term should register in the course during the first fall term they are in residence. Prerequisite: The course is restricted to M.A. students in sociology. Others may be admitted by permission of the Department.

Sociology 53.507F1 or W1

**Social Change and Economic Development**

A critical examination of studies of change and development in historical and contemporary national and transnational systems.

Sociology 53.509F1 or W1

**Philosophy of Social Science I**

The seminar considers the philosophy of language and the basic elements of scientific method, such as the classification of the sciences, the concepts of value, cause and probability, induction and deduction, confirmation of hypotheses, and the concept of truth.

Sociology 53.511T2

**Research Design and Data Analysis**

An integrated approach to the problems involved in the analysis of quantitative data, research design and procedures. This course covers a comprehensive range of methodological issues from research design to data analysis, including the communication of results, sources of data and an ability to assess scholarly literature. The course includes the formulation of research questions, survey questions, use of archival data and case studies.

Sociology 53.512F1 or W1

**Statistical Methods I**

A course on multiple regression analysis, with a review of basic statistical assumptions and techniques, followed by a detailed discussion of multiple regression analysis as a statistical technique. Particular attention will be paid to the practical problems associated with regression analysis of sociological data.

Sociology 53.513F1 or W1

**Statistical Methods II**

The focus will be advanced research methods. Topics will include distributions, sampling distributions, hypothesis testing, and non-parametric methods. There will be an introduction to multivariate techniques, including regression and loglinear models.

Sociology 53.514F1 or W1

**Multivariate Analysis**

This course provides advanced instruction in methods and statistics. Consideration will be

given to multiple regression, factor analysis, canonical analysis.

Sociology 53.515F1 or W1

**Selected Topics in Social Research Topic varies from year to year.**

Students should check with the Department regarding the topic offered.

Anthropology 54.516F1 or W1

**North American Native Studies**

An examination of selected issues in Canadian Indian, Inuit, and Métis history. The course will explore debates over social change, cultural autonomy, native rights, and government policy.

Anthropology 54.517F1 or W1

**Problems in North American Ethnohistory**

This seminar will examine methodological and substantive problems in the history of Canadian native peoples. It will explore controversies concerning the impact of European penetration and colonial policies on inter-tribal relations, cultural identity, and other aspects of native life.

Anthropology 54.519F1 or W1

**Development, Dependency and Gender**

This course will examine varieties of "development" and "dependency" theories, and feminist critiques of both, in analyzing gender relations in the Third and Fourth Worlds. Emphasis will be on recent socialist feminist analyses which focus on the impact of a changing gendered division of labour in all aspects of life. Case studies from around the world will be examined to illustrate the impact of "development" on gender inequality and women's lives.

Sociology 53.520F1 or W1

**Comparative Social Systems**

The seminar explores both perspectives and research procedures employed by sociologists in the systematic and explicit comparison of data from two or more societies. Major emphasis is placed on the theoretical and methodological issues in comparative research. Included among the topics for discussion are the nature of sociological propositions in comparative research, the problem of conceptual equivalence, research designs, and levels of analysis. Examples are drawn from both classical and contemporary comparative studies.

Sociology 53.521F1 or W1

**Comparative Methods in Social Research**

A seminar dealing with current analytical problems and applications of comparative methods in social research. Students are expected to participate in a group research project in which one or more of these methods will be applied.

Anthropology 54.522F1 or W1

**The Anthropology of Underdevelopment**

An anthropological analysis of theoretical and historically concrete issues in the study of variable economic systems ranging from domestic subsistence and peasant production to slavery and capital-dominated markets. Special attention is given to non-capitalist modes of production and social formations, theories of economic modernization, and anthropology's contribution to Marxian explanations of the causes and consequences of hinterland poverty and Third World underdevelopment. Debates over the relationship between the decision making, material provisioning, and cultural symboling processes are also examined.

Sociology 53.524F1 or W1

**Consuming Passions: The Regulation of Consumption, Appearance and Sexuality**

This course examines the rise of consumption and private pleasures and their regulation and self-regulation. It is organized around an examination of the social history of the regulation of two broad fields of consumption: (a) the surfaces of the person: personal appearance, in particular of dress, the body, and of sexuality, and (b) the intakes of the body with particular attention to food, alcohol, and drugs. (Also listed as Law 51.508)

Sociology 53.525T2

**Canadian Society**

A critical examination of sociological models of modern societies and their relevance to Canada. Special attention is given to current research and its application to contemporary issues.

Sociology 53.526F1 or W1

**Sociology of Occupations and Professions**

A consideration of the development of occupational recruitment patterns and manpower problems in developed and developing areas.

Sociology 53.527F1 or W1

**Sociology of Formal Organizations**

A consideration of the forms and processes of bureaucracy in modern society, government and industry.

Sociology 53.529F1 or W1

**Sociology of Science and Technology**

Study of the interaction among science, technology and change in modern societies.

Sociology 53.530F1 or W1

**Social Institutions I**

Topic varies from year to year.

Students should check with the Department regarding the topic offered.

Sociology 53.531F1 or W1

**Social Institutions II**

Topic varies from year to year.

Students should check with the Department regarding the topic offered.

Sociology 53.532F1 or W1

**The Labour Process**

A consideration of the organization of work and production from feudal times to the present. The purpose of the course is to analyze the labour process in advanced capitalist societies by means of the historical comparative method.

Sociology 53.533F1 or W1

**Sociology of Education**

The seminar generally concentrates on a specific topic within the larger field of the sociology of education. Among the topics considered will be the relations between education and other social institutions, the structure of educational opportunity, educational systems and organizations, and the sociology of learning.

Sociology 53.536F1 or W1

**Cultural Studies**

The object of the seminar is to enhance our understanding of the relations between cultural practices and other social practices in definite social formations. Discussions are grounded through the choice of specific Canadian research on topics such as media, art, music, education, pedagogy, etc.

Sociology 53.537F1 or W1

**Psychoanalysis and Cultural Studies**

This course will examine the relationship between psychoanalytic and sociological theory. A particular focus will be on the work of feminist theorists.

Anthropology 54.538F1 or W1/Sociology 53.538F1 or W1

**Feminist Analyses**

This course surveys topics of current theory and research in recent feminist analysis. Both anthropological and sociological literature will be used.

Sociology 53.539F1 or W1

**Cultural Theory**

A survey of developments in European and North American Marxist and Post-Marxist cultural theories of the past quarter century.

Sociology 53.540F1 or W1

**Political Sociology**

An examination of theoretical and empirical work on selected aspects of the state, politics and political behaviour, primarily in North America and Europe.



Anthropology 54.541F1

### **Proseminar in Anthropology I**

This seminar provides an opportunity for students new to the graduate program to encounter anthropology as it is currently practiced at Carleton University, with a special emphasis on the anthropology of signs and symbols, North American native studies, development and underdevelopment. Students participate in faculty discussions of their own current research interests and opportunities for student research. The seminar puts the emphasis on the practice of anthropology and its political and ethical implications. Required of all students entering in fall term, during their first term of residence. Normally students entering at mid-year should register in this course during the first fall they are in residence.

Anthropology 54.542W1

### **Proseminar in Anthropology II**

This seminar examines issues in the design and conduct of anthropological inquiry especially concerning the proposed thesis research of students currently enrolled, the analysis of ethnographic material and the development of explanatory frameworks, all against the background of theoretical debates prevailing in the discipline. It gives students undertaking thesis research an opportunity to discuss specific concerns in the conduct of their own thesis research and findings with faculty, students, and invited discussants.

Prerequisite: Completion of Anthropology 54.541F1 or permission of the Department.

Anthropology 54.543F1 or W1

### **The Anthropology of Signs and Symbols**

This course examines various theoretical and methodological approaches to the anthropology of signs and symbols, their internal workings, and their relationship to other aspects of social life. These approaches may include structural and post-structural semiotics, psychoanalysis, feminism, critical anthropology, neuroanthropology, hermeneutics, and phenomenology. Discussions are grounded through illustrative analyses of concrete case-studies and exemplary cases of possible interpretive strategies. (Also listed as Religion 34.543)

Sociology 53.544F1 or W1

### **Race, Ethnicity and Class in Contemporary Societies**

Various theoretical approaches concerning the persistence and re-emergence of ethnic and/or racial groups are examined. Particular emphasis is given to the intersection and overlap of ethnicity and race with social class.

Sociology 53.545F1 or W1

### **Power and Stratification**

An examination of theories of elite behaviour, social class, and ideology.

Anthropology 54.548

Sociology 53.548F1 or W1

### **Feminism and Materialism**

An examination of recent attempts to develop feminist materialist theory and analyses. Substantive areas may include: the gender division of labour; family and economy; gender and class; gender, race and ethnicity; sexuality; reproduction; theory and politics. Both the anthropological and sociological literature will be utilized.

Sociology 53.549F1 or W1

### **The Politics of Social Movements and the State**

This course investigates the origins, ideologies, strategies and political implications of social and popular movements in North America and Western Europe which have recently tested the legitimacy of advanced capitalist states and industrial systems. Attention is given to the peace, feminist, gay, ecology, and anti-racist movements, as well as to the emergence of the New Right. Among the issues explored are the status of popular movements as vehicles for social change and state restructuring, the transformation of oppositional movements into alternative political parties, and the challenge posed by contemporary movements - both progressive and right wing, to western Marxism, left and liberal politics.

Sociology 53.550F1 or W1

### **Gender Formation and State Formation**

The course examines the role of states in the formation of gender relations, in the context of class and race, and the production of gender as an aspect of state formation. The various levels of the state are conceived as both a site and object of gender politics.

Sociology 53.554F1, W1 or S1

### **Selected Problems in Political Economy I**

A research seminar which explores a selected topic from current research in political economy, such as: (a) the sociology of the state; (b) developments in the theory of culture and ideology; (c) analysis of the sociology of the labour market; (d) developments in socialist-feminist theory. Topic varies from year to year. Students should check with the Department regarding the topic offered. (Also listed as Political Economy 44.551 and Political Science 47.551)

Sociology 53.555F1, W1 or S1

### **Selected Problems in Political Economy II**

A research seminar which explores a selected topic from current research in political

economy, such as: (a) the sociology of the state; (b) developments in the theory of culture and ideology; (c) analysis of the sociology of the labour market; (d) developments in socialist-feminist theory. Topic varies from year to year. Students should check with the Department regarding the topic offered. (Also listed as Political Economy 44.552 and Political Science 47.552)

**Sociology 53.560F1 or W1**  
**Critical Discourse Analysis**

The discursive organization of power, domination, and resistance form the main focus of this course. The relations between discourse, social semiotics, extradiscursive semiotics and social organization will be examined. The approach will draw on the contributions of diverse disciplines to theorizing topics relevant to the central topics being investigated.

**Sociology 53.565F1 or W1**  
**Demographic Analysis**

A seminar devoted to the intensive study of analytical strategies and techniques employed in demographic research. Attention is also given to mathematical and statistical models used in demography, which are relevant to research in other areas of sociology.

**Sociology 53.566F1 or W1**  
**Selected Topics in Sociology**

Topic varies from year to year. Students should check with the Department regarding the topic offered.

**Sociology 53.567F1 or W1**  
**Contemporary Theories of Crime and Social Regulation**

The purpose of this course is to acquaint students with recent developments in theories of criminality and social regulation. Particular reference will be made to the regulatory mechanisms of both public and private spheres within legal institutions, corrections, economic institutions, and the family.

**Sociology 53.568F1 or W1**  
**Women and Work**

This course examines various approaches and issues concerning women and work. Among the topics which may be considered are housework, occupational segregation in the paid labour force, part-time work, the changing economic structure of work, wage inequality, and state policies with respect to childcare, equal pay and work of equal value, and affirmative action.

**Sociology 53.577F1 or W1**  
**Crime, Social Control and Social Change**  
An examination of the role of the discourses and ideologies surrounding crime, criminal processes, and social change. Topics will vary

from year to year and may include such issues as juvenile justice, victimization, corporate crime, criminalization of indigenous peoples, substance use and abuse.

**Sociology 53.582F1 or W1**  
**Departmental Seminar**

Topic varies from year to year. Students should check with the Department regarding the topic offered.

**Sociology 53.583F1 or W1**  
**Critical Theory**

The seminar will focus on recent developments in critical theory based upon its initial formulation by the Frankfurt School, with emphasis upon particular contemporary theories in a given year, e.g., J. Habermas, H. Willems, etc.

**Sociology 53.584F1 or W1**  
**Modern Marxist Theory**

An examination of topics of theory and research in modern Marxist literature; the central focus is on problems of class analysis, the state, and politics in advanced capitalist societies.

**Sociology 53.585F1 or W1**  
**Selected Topics in Sociology**

Topic varies from year to year. Students should check with the Department regarding the topic offered.

**Sociology 53.586F1 or W1**  
**Selected Topics in Sociology**

Topic varies from year to year. Students should check with the Department regarding the topic offered.

**Anthropology 54.587F1 or W1**  
**Selected Topics in the Anthropology of Signs and Symbols**

Topic varies from year to year. Students should check with the Department regarding the topic offered.

**Anthropology 54.588F1 or W1**  
**Selected Topics in North American Native Studies**

Topic varies from year to year. Students should check with the Department regarding the topic offered.

**Sociology 53.589F1 or W1**  
**The Logic of the Research Process**

An examination of the research process, including the phases of conceptualization, choice of indicators, sampling, data collection, and analysis. Published articles will be studied as exemplars of the range of possible research strategies.

Anthropology 54.589F1 or W1

**Selected Topics in the Anthropology of Development and Underdevelopment**

Topic varies from year to year.

Students should check with the Department regarding the topic offered.

Sociology 53.590F1, W1, S1

**Tutorial**

Anthropology 54.590F1, W1, S1

**Tutorial**

Sociology 53.595F4, W4, S4

**Course Work Comprehensive in Sociology**

Available for students in a course work M.A. who by the third term in their M.A. program have not yet completed their written and oral examinations. Completion of this course does not reduce the formal requirement of 5.0 credits.

Anthropology 54.595F4, W4, S4

**Course Work Comprehensive in Anthropology**

Available for students in a course work M.A. who by the third term in their M.A. program have not yet completed their written and oral examinations. Completion of this course does not reduce the formal requirement of 5.0 credits.

Anthropology 54.596F1, W1, S1

**Field Seminar**

This course is concerned with the conduct of directed field research, by special arrangement (for individuals or groups), to be combined with readings and papers under the supervision of a faculty member. The course may normally be taken only once in a student's program.

Sociology 53.597F1, W1, S1

**Placement in Sociology**

This course is for students in the Concentration in Quantitative Methodology who have been admitted into the Cooperative Education option. This option is intended to provide an opportunity for students to enhance their educational experience through a work placement directly related to their area of interest and expertise. This course is required of all students admitted into this option. Once admitted, students arrange the terms and conditions of their cooperative education placement with their supervisors and the graduate coordinator. Grades for the cooperative education placement are assigned in consultation between the placement supervisor and the graduate coordinator.

Anthropology 54.597F1, W1, S1

**Placement in Anthropology**

This course offers the student an opportunity to earn academic credit by engaging in

research activities under the supervision of professional researchers in museums, government departments, non-governmental organizations, or other professional research settings. Grades are assigned in consultation between research placement supervisors and the coordinator of the graduate program in anthropology. Placement research must be related to the preparation of the master's thesis.

Sociology 53.598F2, W2, S2

**M.A. Research Essay**

Students may enrol in this course for a maximum of three consecutive terms of study, including one summer term. Students must enrol in this course not later than the beginning of the second full year of study.

Sociology 53.599F4, W4, S4

**M.A. Thesis**

Anthropology 54.599F4, W4, S4

**M.A. Thesis**

Sociology 53.600T2

**Doctoral Seminar**

An in-depth study of current research in sociology including an enquiry into research techniques, conceptualization and attendant theoretical issues. This course is required of all first-year doctoral students in sociology.

Sociology 53.601F1 or W1

**Selected Topics in Sociology**

Topic varies from year to year.

Students should check with the Department regarding the topic offered.

Sociology 53.690F1, W1, S1

**Tutorial**

Sociology 53.699F, W, S

**Ph.D. Thesis**



## School of Languages, Literatures and Comparative Literary Studies: Spanish

Dunton Tower 1419  
Telephone: 520-5644

**Director, R. Jeffreys**

**Associate Director (Spanish), Ross Larson**

Students currently enrolled in programs offered by the Discipline of Spanish are governed by the requirements contained in the 1997-98 Graduate Calendar.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Spanish 38.505F1 or W1  
**History of the Spanish Language I**  
Topic may vary from year to year.

Spanish 38.506F1 or W1  
**History of the Spanish Language II**  
Topic may vary from year to year.

Spanish 38.515F1 or W1  
**Special Topic on Medieval Literature**  
Topic may vary from year to year.

Spanish 38.520F1 or W1  
**Special Topic on Golden Age**  
Topic may vary from year to year.

Spanish 38.525F1 or W1  
**Studies in Eighteenth-Century Literature**  
Topic may vary from year to year.

Spanish 38.530F1 or W1  
**Problems of Modern Spanish Literature**  
Topic may vary from year to year.

Spanish 38.550F1 or W1  
**Aspects of Spanish-American Literature before 1888**  
Topic may vary from year to year.

Spanish 38.560F1 or W1  
**Aspects of Spanish-American Literature after 1888**  
Topic may vary from year to year.

Spanish 38.570F1 or W1  
**Special Problems in Spanish-American Literature**  
Topic may vary from year to year.

Spanish 38.590T2, S2  
**Directed Studies**

Spanish 38.591F1, W1, S1  
**Directed Studies**

Spanish 38.595F1, W1, S1  
**Directed Readings**  
Additional half courses, designed in particular for students requiring special assistance in preparing for comprehensive examinations. Students are required to be enrolled in this course at the time of taking the examination.

Spanish 38.599F, W, S  
**M.A. Thesis**

# Systems and Computer Engineering

Mackenzie Building 4462  
Telephone: 520-5740  
Fax: 520-5727  
E-mail: gradinfo@sce.carleton.ca

## The Department

**Chair of the Department, R.A.Goubran**

**Associate Chair for Graduate Studies, H.M. Schwartz**

**Director, Telecommunications Technology Management Program, A.J. Bailetti**

**In addition to University and Graduate Faculty regulations, all Engineering departments share common procedures that are described in Section 18 of the General Regulations (see p. 66).**

The Department of Systems and Computer Engineering has a large and active graduate program. We offer four graduate programs of study:

- \* M.Eng. in Electrical Engineering
- \* M.Eng. in Telecommunications Technology Management
- \* M.Sc. in Information and Systems Science
- \* Ph.D. in Electrical Engineering.

In addition, certain faculty members in the department are members of the Ottawa-Carleton Institute for Computer Science which offers a program leading to the M.C.S. degree. This program is more fully described on p. 134 of this Calendar.

The programs are described in more detail below.

## Fields of Research and Study

Research in the Department centres upon the analysis and design of engineering systems which process and transmit information and have computers as components. Within this context, several interrelated areas of study receive major attention:

### *Communication Systems*

- \* Broadband, ATM, and Multimedia Networks
- \* Wireless Data Networks
- \* Portable and Mobile Communication Systems
- \* Signal Processing
- \* Network Management
- \* Software Methods

- \* Coding and Information Theory

### *Computer Systems*

- \* CAD/CASE of Software and Systems
- \* Real-Time and Distributed Computing
- \* Software Engineering
- \* Object-Oriented Systems
- \* Design and Management of Distributed Application Systems
- \* Computer Resource Management
- \* Modelling of Client-Server Systems
- \* Data Base Systems
- \* Knowledge-based Systems
- \* Image Processing Systems
- \* Signal Processing Systems
- \* Robotic Systems
- \* Control Systems

### *Analysis Techniques*

- \* Modelling and Simulation
- \* Performance Analysis
- \* Optimization

### *Management of Engineering Processes*

- \* Management of Design Systems
- \* Software Project Management
- \* Business and Technology Opportunities
- \* Integrated Product Development

Course work provides students with the fundamental material and allows specialization in one or more of the above areas as desired. Thesis topics include both theoretical studies and the related problems of practicable realizations.

## Industrial Connections

The Department is a member of several Centres of Excellence:

- \* The Canadian Institute for Telecommunications Research
- \* Communications and Information Technology Ontario (CITO) (this replaces the older Telecommunications Research Institute of Ontario of which we were founding members).
- \* TeleLearning Network (TLN), a National Centre of Excellence.

Current research areas of the centres with major participation from the Departments are: broadband ISDN access networks, transmission methods for ISDN, methods for telecommunications software, mobile and portable wireless networks, VLSI in communications and network management using artificial intelligence methods, and wireless indoor digital communications.

Full advantage is taken of the technology-oriented industry-government-university complex in the Ottawa area. Co-operative projects are in progress with Nortel, Newbridge, Mitel, Stentor, the Department of Communications, Communications Research Centre, NRC, Bell Canada and the Department of National Defence. We are also involved in the Research Program in Managing Technological Change (MATCH), which is of particular interest to students in the M.Eng. in Telecommunications Technology Management.

### Research Facilities

The Department has an excellent collection of facilities for advanced research in systems and computer engineering. There are about 100 engineering workstations, primarily SUN, but also NT and other types, on an Ethernet local area network, multiprocessor target systems, and many other stand-alone and networked workstations. The network is part of the Internet and so has access to the World Wide Web, electronic mail, network news, and much public domain research software. There are also numerous high-end PCs and Macintosh computers, many equipped for desktop video conferencing.

Software includes all of the standard programming and AI languages, symbolic algebra systems, wordprocessors, and various packages specific to telecommunications, signal processing, performance analysis, software engineering, and other areas of research.

The communications and image and signal processing labs provide state-of-the-art test, measurement, and prototyping facilities which include radio transmission and test equipment (up to EHF frequencies), co-processor boards, audio equipment, data acquisition hardware, interactive video conferencing lab equipment, robots, etc.

The main research laboratories include the following:

- \*Broadband Networks
- \*Digital Signal Processing
- \*Image Processing
- \*Internet System Software Performance

- \*Managing Technological Change
- \*Mobile and Portable Communications
- \*Network Management and Artificial Intelligence
- \*Personal Communication Systems
- \*Radio Communications
- \*Real-Time and Distributed Systems
- \*Robotics, Automation, and Control
- \*TeleLearning

### Master of Engineering in Electrical Engineering

The M.Eng. in Electrical Engineering is offered through the Ottawa-Carleton Institute for Electrical and Computer Engineering (OCIECE) which is jointly administered by the Department of Systems and Computer Engineering and the Department of Electronics at Carleton University, and the School of Information Technology and Engineering at the University of Ottawa. For further information about the M.Eng. in Electrical Engineering, including admission and program requirements, please see the OCIECE information beginning on page 152.

The M.Eng. is also available as part of ConGESE (Consortium for Graduate Education in Software Engineering), a collaborative program offering a specialization in software engineering. This program is geared towards software professionals working for participating industrial partners. The ConGESE program imposes further regulations and requirements on the existing program. The degree awarded will in each case specify the discipline of the participating unit with specialization in software engineering. Additional information is available from the graduate supervisor.

### Doctor of Philosophy in Electrical Engineering

The Ph.D. in Electrical Engineering is offered through the Ottawa-Carleton Institute for Electrical and Computer Engineering (OCIECE) which is jointly administered by the Department of Systems and Computer Engineering and the Department of Electronics at Carleton University, and the School of Information Technology and Engineering at the University of Ottawa. For further information about the Ph.D. in Electrical Engineering, including admission and program requirements, please see the OCIECE information beginning on p.152.



## Master of Engineering in Telecommunications Technology Management

The M.Eng. in Telecommunications Technology Management educates electrical engineers and computer scientists in the management of the engineering processes that result in innovative telecommunications systems, products, and services. For further information, please see below.

## Master of Science in Information and Systems Science

The M.Sc. in Information and Systems Science is specifically designed for those who do not have a background in electrical engineering or computer science. This program is offered in cooperation with the School of Computer Science and the School of Mathematics and Statistics at Carleton University. Please see p. 152 for details.

## Master of Engineering in Telecommunications Technology Management

The Department of Systems and Computer Engineering offers a program of study and research leading to the degree of Master of Engineering in Telecommunications Technology Management.

The objective of the program is to train engineers and computer scientists to become competent and efficient managers of the engineering processes that deliver innovative telecommunications systems, products, and services. The emphasis is on design, development, manufacture, and technical support, areas for which engineers are normally responsible and where their technical expertise and practical knowledge are critical.

The program focuses on research in the synthesis between communication systems engineering and management of engineering processes. Within this context the following areas receive major attention:

- \* Management of Engineering Processes
- \* Network Design, Protocols and Performance
- \* Software Engineering
- \* Wireless and Satellite Communications
- \* Manufacturing Systems Analysis

Close links are maintained with the engineering and technological communities, and an effort is made to direct students to thesis and project work of current theoretical and practical significance. The research results should provide useful contributions to the efficient

management of engineering processes and the related activities in the telecommunications field.

## Admission Requirements

The normal requirement for admission to the master's program is a bachelor's degree in electrical engineering, computer science or a related discipline, with at least high honours standing. Candidates are required to have two years experience in technical work in telecommunications prior to admission.

Candidates applying for admission with degrees not in the discipline of engineering will be considered by the admissions committee. The committee is responsible for establishing criteria for degree equivalencies.

## Program Requirements

Subject to the approval of the admissions committee, students in the master's program may choose to complete the degree by successfully completing either a thesis or a project.

### *Master's Degree by Thesis*

All master's students in the thesis option are required to complete a total of 5.5 credits as follows:

- \* 1.5 compulsory credits including: 96.501; 96.502; and 96.503
- \* 2.0 approved credits from the list of restricted elective courses below
- \* a thesis equivalent to 2.0 credits

### *Master's Degree by Project*

All master's students in the project option are required to complete a total of 5.5 credits of which at least 5.0 must be at the 500-level or above, as follows:

- \* 1.5 compulsory credits including: 96.501; 96.502; and 96.503
- \* 2.0 approved credits from the list of restricted elective courses below
- \* 1.0 credit of approved non-restricted electives
- \* a graduate project equivalent to 1.0 credit

## Restricted Elective Courses

Students in the master's program must complete 1.0 credit in the field of management of engineering processes and 1.0 credit in communication systems engineering. Courses in each of the four sub-fields and the field of management of engineering processes are listed below.

## Systems and Computer Engineering

The sub-fields in communication systems engineering are:

- \* Software Engineering
- \* Wireless and Satellite Communications
- \* Network Design, Protocols and Performance
- \* Manufacturing Systems Analysis

All courses in the field of communication systems engineering are offered by the Department of Systems and Computer Engineering and begin with the prefix 94.

### *Communication Systems Engineering*

- \* Software Engineering  
94.507, 94.511, 94.531, 94.535, 94.553, 94.571, 94.573, 94.574, 94.576, 94.577, 94.579, 94.582
- \* Wireless and Satellite Communications  
94.553, 94.554, 94.566, 94.568
- \* Network Design, Protocols and Performance  
94.501, 94.504, 94.505, 94.507, 94.511, 94.519, 94.521, 94.527, 94.553, 94.567, 94.576, 94.581, 94.588
- \* Manufacturing Systems Analysis  
94.501, 94.504, 94.582, 92.527

### *Management of Engineering Processes*

96.504, 96.505, 96.506, 96.508, 96.510, 96.511, 96.512, 96.513, 96.514

## Non-Restricted Elective Courses

All students in the project option of the master's program are required to complete 1.0 credit from those offered by the Department of Electronics, Department of Mechanical and Aerospace Engineering, Department of Systems and Computer Engineering, School of Industrial Design, or School of Computer Science.

## Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Courses in the field of *communication systems engineering* are described below. Courses in the field of *management of engineering processes* are described beginning on page 338.

Engineering 94.501W1 (ELG6101)

### **Simulation and Modelling**

Simulation as a problem-solving tool. Mathematical foundations: random variate generation, parameter estimation, confidence interval, simulation algorithm. Simulation languages: SLAM, SIMULA, SIMSCRIPT. Examples: computers and protocols, urban traffic, harbours and airport capacity planning, manufacturing capacity planning, inventory systems.

Engineering 94.503F1 (ELG6103I)

### **Discrete Stochastic Models**

Models for software and computer systems, and communications networks, with discrete states, instantaneous transitions and stochastic behaviour. Communicating finite state machines and Petri Nets. Stochastic behaviour leading to Markovian models (including stochastic Petri Nets). Review of concepts of probability, and theory of Markov Chains with discrete and continuous parameters. First-passage problems. Birth-death processes and basic queuing theory. Numerical methods for Markov Models.

Engineering 94.504F1 (ELG6104)

### **Mathematical Programming for Engineering Applications**

An introduction to algorithms used for the optimization of complex systems. Topics include linear programming (with duality and post-optimality analysis), nonlinear programming, dynamic programming integer and mixed-integer programming and combinatorial search methods, and network flow programming. Emphasis is on practical algorithms for engineering applications, e.g., VLSI design, message routing, etc.

Engineering 94.505W1 (ELG6105)

### **Optimization Theory and Methods**

A second-level course in optimization theory and computer-oriented optimization methods. Lagrange's method of undetermined multipliers. Unconstrained optimization: steepest-descent, Newton-Raphson, conjugate gradient, variable metric, and Powell-Zangwill methods. Nonlinear programming: Kuhn-Tucker conditions, saddle point theory and dual problems, computational techniques. Application to nonlinear engineering system identification, network synthesis problems, filter design. Function space techniques and introduction to optimal control.

Engineering 94.506W1 (ELG6106)

**Design of Real-Time and Distributed Systems**

Real-time and distributed systems: characteristics, issues. Requirements and architectures will be represented using timethreads. Decomposing and recomposing timethreads and architectures. Analyzing designs for robustness, modularity, extensibility, adaptability. Equivalent more detailed formal representation and analysis using LOTOS and Petri Nets. Adding performance information and analyzing performance, e.g., with timed Petri Nets. Principles for performance engineering. Implementation issues. Tools. Major course project.

Prerequisite: Engineering 94.333 and 94.485 or similar experience.

Engineering 94/95.507F1 (ELG6107)

**Expert Systems**

Survey of some landmark expert systems; types of architecture and knowledge representation; inferencing techniques; approximate reasoning; truth maintenance; explanation facilities; knowledge acquisition. A project to implement a small expert system will be assigned. Prerequisite: Computer Science 95.407 or 95.501 or permission of the Department.

Engineering 94.511W1 (ELG6111)

**Design of High Performance Software**

Designing software to demanding performance specifications. Models of profiling and performance requirements. Performance engineering within the software design process. Improvement of existing designs by the application of performance engineering principles for sequential and concurrent software. Constructing computation graphs, workload models, and performance models for a system. The use of standard model solvers. Partitioning functionality among concurrent processes or tasks. Case studies.

Prerequisite: Engineering 94:574 and a course in software engineering, or the equivalent.

Engineering 94.512W1 (ELG6112)

**Performance Measurement and Modelling of Distributed Applications**

Performance measurements, metrics and models of distributed systems and applications. Benchmarks, workload characterization, capacity planning, tuning and system sizing. Introduction to the design and analysis of experiments. Performance monitors, and the correlation of measured information with application resource consumption to support the software performance engineering process. Using metrics to help understand the performance behaviour of distributed applications.

Prerequisite: Engineering 94.511 or the equivalent.

Engineering 94.518W1 (ELG6118)

**Topics in Information Systems**

Students participate in a group project designing and developing an expert system of significant size in an organized manner. Specification of the system's aims, design in terms of knowledge representation, knowledge acquisition and knowledge use, prototyping, implementation and testing are covered in a mix of lectures, interactive tutorials and project assignments.

Prerequisite: Engineering 94/95.507 or 94.583 or equivalent.

Engineering 94.519W1 (ELG6119)

**Teletraffic Engineering**

Congestion phenomena in telephone systems, and related telecommunications networks and systems, with an emphasis on the problems, notation, terminology, and typical switching systems and networks of the operating telephone companies. Analytical queuing models and applications to these systems.

Prerequisite: Engineering 94.553 or ELG5119 or the equivalent.

Engineering 94.520F1 (ELG6120)

**Algebraic Coding Theory**

Introduction to algebra: groups, rings and fields; vector spaces and matrices; group codes: generator and parity check matrices; Hamming codes and the Hamming bound; bounds on the dimension of a linear code; random coding bounds; dual codes and MacWilliam's identities; syndrome decoding; Reed-Muller codes; polynomial rings and cyclic codes; irreducible and primitive polynomials; encoding and decoding of cyclic codes; BCH and Reed-Solomon codes; decoding using the Berlekamp-Massey and Euclidean algorithms; algebraic curves and Goppa codes.

Precludes additional credit for Engineering 94.557 (ELG6157).

Engineering 94.521F1 (ELG6121)

**Computer Communication**

Types of computer networks, performance criteria. OSI Layered Model with emphasis on transport, network and data-link layers. Examples of public networks. Routing and protocol efficiency. Queuing and analysis of networks. Local area networks, protocols and performance analysis of CSMA-CD, token passing and polling. Introduction to ISDN and broadband networks.

Precludes additional credit for Engineering 92.567 (ELG5374) or 94.462 (ELG4181).

Prerequisite: Undergraduate preparation in probability theory equivalent to Mathematics 69.352.



Engineering 94.527W1 (ELG6127)

### **Distributed Systems Engineering**

Techniques for representing distributed systems: precedence graphs, petrinets, communicating state-machines etc. Processes, threads, synchronization and inter-process communication techniques, RPC. Protocol: OSI model, application and presentation layers. Middleware for client-server application management, CORBA. Resource management: processor allocation and load sharing. Real-time issues and scheduling.

Prerequisites: Permission of the Department.

Engineering 94.535F1 (ELG6135)

### **Representations, Methods and Tools for Concurrent Systems**

Selected representations and methods for concurrent systems that are supported by current and emerging CAD/CASE tools. A colloquium course with most lectures consisting of student presentations/discussions, supplemented from time to time by talks from invited experts on topics of particular interest. The course is supported by a laboratory containing a selection of interesting tools, such as Statemate, Timebench, MLog, Teamwork, Adagen, a Lotos interpreter, and others. Limited enrolment.

Prerequisite: Permission of the Department.

Engineering 94.541F1 (ELG6141)

### **Adaptive Control**

Analysis of nonlinear dynamic systems with emphasis on stability. Lyapunov and hyperstability theories. Introduction to system identification. The least squares and recursive least squares approaches. Model reference adaptive control. The self-tuning regulator. Issues in parameter convergence and stability. Robustness properties of adaptive systems. Case studies will include applications to process control and robotics. Students will be required to prepare a critical review of the current literature.

Prerequisite: Engineering 94.552 or equivalent.

Engineering 94.542F1 (ELG6142)

### **Advanced Dynamics With Applications to Robotics**

Kinematics of rigid bodies and robot manipulators. Use of the Denavit-Hartenberg principle. Forward and inverse kinematics of manipulators. Momentum and energy principles. Lagrange equations and Hamilton's principle. Dynamics of lumped parameter and continuous systems. Natural modes and natural frequencies. Forced vibrations. General dynamics of robot manipulators.

Engineering 94.552F1 (ELG6152)

### **Advanced Linear Systems**

Review of basic linear systems: input-output relations, superposition, impulse response,

convolution. Transform methods in systems analysis. Fourier and Laplace transforms. Time-frequency relationships. Discrete time systems, the Z transform. State space representation of the systems: basic concepts, canonical realizations. Observability and controllability of continuous and discrete time realization. Solution of state equations and modal decomposition. Linear state variable feedback and modal controllability. Abstract approach to state space realization methods. Geometric interpretation of similarity transformations.

Engineering 94.553F1, W1 (ELG6153)

### **Stochastic Processes**

Basic concepts of randomness, as applied to communications, signal processing, and queuing systems; probability theory, random variables, stochastic processes; random signals in linear systems; introduction to decision and estimation; Markov chains and elements of queuing theory.

Precludes additional credit for Engineering 92.519 (ELG5119).

Engineering 94.554F1 (ELG6154)

### **Principles of Digital Communication**

Elements of communication theory and information theory applied to digital communications systems. Characterization of noise and channel models. Efficient modulation and coding for reliable transmission. Spread spectrum and line coding techniques.

Precludes additional credit for Engineering 92.556 (ELG5375).

Prerequisite: Engineering 94.553 or ELG5119 or the equivalent (may be taken concurrently).

Engineering 94.558F1 (ELG6158)

### **Digital Systems Architecture**

New architectural concepts in the design of computer systems are introduced. Discussions include system building blocks (arithmetic units, central processing units, control units, input/output and memory devices) and methods to achieve speed-up (instruction lookahead, pipe-lining, memory interleaving, associative memory, SIMD and MIMD multiprocessing). Examples of current computer systems are used for discussions.

Prerequisite: Engineering 94.457 or the equivalent.

Engineering 94.560W1 (ELG6160)

### **Adaptive Signal Processing**

Theory and techniques of adaptive filtering, including gradient and LMS methods; adaptive transversal and lattice filters; recursive least squares; fast recursive least squares; convergence and tracking performance; systolic array techniques. Applications, such as adaptive prediction, channel equalization; echo cancellation; speech coding; antenna

beamforming; system identification in control systems; spectral estimation; neural networks.

Precludes additional credit for Engineering 92.580 (ELG5377).

Prerequisites: Engineering 94.553 or ELG5119 or equivalent; Engineering 94.562 or ELG5376 or equivalent.

Engineering 94.561W1 (ELG6161)

### **Neural Signal Processing**

Basic concepts in decision theory and multi-dimensional function approximation. The least squares adaptive algorithm. The generalized delta rule. Multi-layer perceptrons and the back-propagation algorithm. Approximation of non-linear functions. Radial basis functions. Self-organized maps. Applications of neural signal processing to control, communications and pattern recognition. Software and hardware implementation of neural networks.

Precludes additional credit for Engineering 92.579 (ELG5796).

Prerequisite: Engineering 94.553 or ELG6153 or equivalent. May be taken concurrently with 94.553.

Engineering 94.562F1 (ELG6162)

### **Digital Signal Processing**

Signal representations, Z transform and difference equations. Theory, design of FIR, IIR filters. Discrete Fourier transform: properties, implementation via fast algorithms (radix-m FFT, PFA, WFTA). Chirp-z transform. Cepstral analysis. Decimation/interpolation. Random signal analysis: estimators, averaging, correlation, windowing, Input/output and quantization effects. Application overview: Analog-digital converters linear, companded), digital audio (CD, DAT), speech analysis and synthesis. Programmable DSP microcomputers: contemporary commercial architectures, application to implementation of DSP algorithms. Case studies: Linear predictive coding of speech (LPC), radix/4 FFT, spectrograph. Precludes additional credit for Engineering 92.557 (ELG5376).

Engineering 94.563W1 (ELG6163)

### **Digital Signal Processing: Microprocessors, Software and Applications**

Digital signal processing (DSP) algorithm structure. Architectural features of CISC, RISC, and DSP computers. Data representation, addressing, and arithmetic processing. Contemporary single (TMS320C25), dual (DSP 56000), and multiple (TMS320C30, DSP96000) accumulator/operand commercial architectures, DSP multiprocessors (TMS320C80). Algorithm/software/hardware architecture interaction. Programming techniques and program examples. Software development cycle. Hardware

and software development tools. Program activity analysis techniques. Case studies: linear predictive vocoder, DFT, echo cancellation. Interfacing and input/output. Codex.

Prerequisite: Engineering 94.562 or ELG5376 or the equivalent.

Engineering 94.564W1 (ELG6164)

### **Advanced Topics in Digital Signal Processing**

Recent and advanced topics in the field of digital signal processing and its related areas.

Prerequisites: Engineering 94.562 or ELG5376 or the equivalent.

Engineering 94.565W1 (ELG6165)

### **Advanced Digital Communication**

Digital signalling over channels with intersymbol interference (ISI) and additive Gaussian noise. Error probability analysis. Fading multipath channels as arise in terrestrial Line-of-Sight (LOS) and mobile/portable communications, diversity concepts: modeling and error probability performance evaluation. Synchronization in digital communications. Spread spectrum in digital transmission over multipath fading channels.

Precludes additional credit for Engineering 92.574 (ELG5780).

Prerequisite: Engineering 94.554 or ELG5375 or the equivalent.

Engineering 94.566W1 (ELG6166)

### **Introduction to Mobile Communications**

Signal strength prediction techniques: propagation models and statistical coverage. Mobile radio channel characterization: statistical characterization of mobile radio fading channel in indoor and outdoor environment, delay spread models and coherence bandwidth, models for digital transmission. Co-channel and adjacent channel interference: interference models, and outage probabilities. Modulation and transmission systems: signal to noise calculations in fading environment, performance of digital systems in fading. Signal processing in mobile radio: diversity and its applications in MRS, impact of diversity on baseband interference, noise and random FM. Adaptive techniques to combat interference and fading: adaptive equalization and adaptive arrays. Introduction to mobile radio systems. Co-requisite: Can be taken concurrently with Engineering 94.553 and 94.554.

Engineering 94.567F1 (ELG6167)

### **Source Coding and Data Compression**

Discrete and continuous sources: the rate distortion functions. Discrete source coding: Huffman coding, run length encoding. Continuous source coding: waveform construction coding; PCM, DPCM, delta modulation; speech compression by parameter extraction;

predictive encoding; image coding by transformation and block quantization. Fourier and Walsh transform coding. Compression by tree coding. Applications to telecommunication signals and storage; speech, television, facsimile. Prerequisite: Engineering 94.553 or ELG5119 or the equivalent.

Engineering 94.568W1 (ELG6168)

### **Wireless Communication Systems Engineering**

Multiuser cellular and personal radio communication systems: frequency reuse, traffic engineering, system capacity, mobility, and channel resource allocation. Multiple access principles, cellular radio systems, signalling and interworking. Security and authentication. Wireless ATM, satellite systems, mobile location, wireless LANs, wireless local loops, broadband wireless etc.

Corequisites: Engineering 94.553 or ELG5119, and 94.554 or ELG5375, or their equivalents.

Engineering 94.569W1 (ELG6169)

### **Digital Television**

Television standards: NTSC, PAL, SECAM, and HDTV. Sampling and quantization of television signals: rec 601-1. Digital video compression: inter and intra-frame methods, spatial and transform/wavelet coding; H.261 and MPEG standards. Video conferencing systems and other digital video processing applications.

Engineering 94.570W1 (ELG6170)

### **Spread Spectrum Systems**

Fundamentals: jamming, energy allocations, system configurations, energy gain, applications such as antijam, low probability of intercept, multiple access, time of arrival. Antijam systems: parameters, jammer waveforms, uncoded and coded direct sequence BPSK, uncoded and coded binary FSK, interleaver/hop tradeoff, coder BER bounds, cutoff rates, DS-BPSK and pulse jamming bounds, FH-MFSK and partial band jamming bounds, diversity for FH-MFSK, concatenation of codes. Pseudo-noise generators: statistical properties of M sequences, Galois field connections, nonlinear feed forward logic, DS and FH multiple access design. Code synchronizers: single dwell and multiple dwell serial PN acquisition for DS, delay locked loop and Tau-Dither loop PN tracking for DS, time and frequency synchronization for FH.

Engineering 94.571F1 (CSI5117)

### **Operating System Methods for Real-Time Applications**

Principles and methods for operating system design with application to real-time, embedded systems. Concurrent programming: mechanisms and languages; design approaches and issues; run-time support (kernel); I/O han-

dling. Methods for hard real-time applications. Methods for distributed systems. Programing assignments will be in a suitable programing language.

Prerequisites: Engineering 94.333 or 94.574 or equivalent courses and/or experience. Programing experience in high level and assembly languages.

Engineering 94.573F1 (ELG6173)

### **Integrated Database Systems**

Database definitions, objectives, applications, and architectures. Database design process; conceptual design based on the entity-relationship model and on object-oriented models. Relational data model: relational algebra and calculus, normal forms, data definition and manipulation languages. Implementation of database management systems: data dictionary, transaction management, recovery and concurrency control. Current trends in database systems: object-oriented, knowledge-based, multimedia and distributed databases. Prerequisite: Engineering 94.574 or the equivalent.

Engineering 94.574F1 (ELG6174)

### **Elements of Computer Systems**

Subjects covered include: concepts in basic computer architecture, assembly languages, high level languages including object orientation, operating system concepts (including concurrency mechanisms such as processes and threads), runtime systems, and distributed system environments. Designed for graduate students without extensive undergraduate preparation in computer system engineering (or the equivalent experience) yet with a firm grasp of programming in at least one high level language.

Prerequisites: Programing experience with at least one high level language and permission of the Department.

Engineering 94.576F1 (ELG6176)

### **Analytical Performance Models of Computer Systems**

Analytical modelling techniques for performance analysis of computing systems. Theoretical techniques covered include single and multiple class queuing network models, together with a treatment of computational techniques, approximations, and limitations. Applications include scheduling, memory management, peripheral devices, databases, multiprocessing, and distributed computing. Prerequisite: Engineering 94.503, 94.553 or ELG5119, or the equivalent.

Engineering 94.578 (ELG6178)

### **Development of Real-Time and Distributed Software with Reusable Components**

Advanced object-oriented design and programming of real-time and distributed sys-



tems using C++ and/or Java. Object-oriented features: inheritance, polymorphism, templates, exception handling. Design patterns and frameworks for distributed systems, with examples from communication applications. Design issues for reusable software.

Precludes additional credit for Engineering 94.599 (ELG6179) (if taken during 1996-97).

Prerequisites: Knowledge of C++ and approval of the Department.

Engineering 94.579F1, W1 (ELG6179)

#### **Advanced Topics in Software Engineering**

Recent and advanced topics in the field of software engineering and related areas. Primary references are recent publications in the field.

Prerequisite: Permission of the Department.

Engineering 94.580F1 or W1, (ELG 6180)

#### **Network Computing**

Design and Java implementation of distributed applications that use telecommunication networks as their computing platform. Basics of networking; Java networking facilities. Introduction to open distributed processing; CORBA, JavalDL, JavaRMI, CGI/HTTP, DCOM, Componentware; Enterprise JavaBeans, ActiveX. Agents: Java code mobility facilities. Security issues; Java security model.

Engineering 94.581F1 (ELG6181)

#### **Advanced Topics in Computer Communications**

Recent and advanced topics in computer-communication networks intended as a preparation for research. Students are expected to contribute to seminars or present lectures on selected topics.

Prerequisites: Engineering 94.521 or ELG5374 or equivalent and permission of the Department.

Engineering 94.582F1 (ELG6182)

#### **Introduction to Information and System Science**

An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queuing systems, optimization. (Also listed as Mathematics 70.582, Computer Science 95.582 and Information and Systems Science 93.582)

Engineering 94.583W1 (ELG6183)

#### **Logic Programming**

Review of relational databases, first order predicate calculus, semantics of first order models, deductive querying. Proof theory, unification and resolution strategies. Introduc-

tion to Prolog, and/or parallelism and Concurrent Prolog. Applications in knowledge representation and rule based expert systems.

Engineering 94.584F1, W1 (ELG6184)

#### **Advanced Topics in Communications Systems**

Recent and advanced topics in communications systems.

Prerequisite: Permission of the Department.

Engineering 94.586F1 (ELG6186)

#### **Object Oriented Design of Real-Time and Distributed Systems**

An advanced course in software design that deals with system design issues at a high level of abstraction. High-level design models: use case maps for large-scale behaviour patterns at the level of architecture; high-level class relationship diagrams for traditional object-oriented concerns. Relationships between these models, and between them and conventional detailed-design models at the level of methods, messages, and communicating state machines. Design patterns with these models. Stepwise methods for forward engineering, reverse engineering, and re-engineering in terms of these models. Study of examples such as telephony systems, object-oriented GUIs, distributed messaging systems, object request brokers, conventional object-oriented frameworks such as HotDraw, and object-oriented frameworks for real-time and distributed systems such as ACE. Substantial course projects on an application chosen by the student.

Prerequisite: Permission of the Department.

Engineering 94.587F1, W1, S1 (ELG6187)

#### **Advanced Topics in Computer Systems**

Recent and advanced topics in computer systems. The course will generally focus on one or more of the following areas: specification, design, implementation, and modeling/analysis. Students may be expected to contribute to lectures or seminars on selected topics.

Prerequisite: Permission of the Department.

Engineering 94.588W1 (ELG6188)

#### **Communications Network Management**

Overview of network management issues, WANs and LANs. The Internet and ISO models of network management. Network management protocols SNMP, CMIP, CMOT, etc. Events, Managed Objects, and MIBs. Fault management techniques, models and algorithms. Current diagnostic theory and its limitations. AI and machine learning approaches. Monitoring and fault management tools, examples, recent products.

Prerequisite: Engineering 94.521 or equivalent.

### Engineering 94.590F1, W1, S1 **Systems Engineering Project**

Students pursuing the non-thesis M.Eng. program conduct an engineering study, analysis, and/or design project under the supervision of a faculty member.

### Engineering 94.591F2, W2, S2 **Systems Engineering Project**

Project similar to Engineering 94.590, but either of greater scope or longer duration.

### Engineering 94.593F2, W2, S2 **Cooperative Program Project**

A one-term course, carrying a full-course credit, for students pursuing the cooperative M.Eng. program. An engineering study, analysis, and/or design project under the supervision of a faculty member. This course may be repeated for credit.

### Engineering 70/94/95.595F4, W4, S4 **M.C.S. Thesis**

### Engineering 94.596F1, W1, S1 (ELG6196) **Directed Studies**

### Engineering 70/93/94/95.598F3, W3, S3 **M.Sc. Thesis in Information and Systems Science**

### Engineering 94.599F4, W4, S4 **M.Eng. Thesis**

### Engineering 94.699F, W, S **Ph.D. Thesis**

*The following are courses in the field of management of engineering processes, and begin with the prefix 96.*

### Engineering 96.501F1 **Management Principles for Engineers**

Management topics critical for dynamic telecommunications technology-based companies to compete through the introduction of new products into the global market. The course is intended to create a common level of knowledge among students on topics in management of projects, leadership, basic managerial economics, industrial marketing and organizational behaviour.

### Engineering 96.502F1 **Telecommunications Technology**

Comprehensive review of the fundamentals of telecommunications technology. The importance of bandwidth, communications reliability and networks are emphasized. Topics covered include: the nature of information sources and the coding of their outputs; nature of channels and their characteristics; nature of signals and their behaviour in physical channels, their generation and reception; nature of interconnection, networks, signaling and switching; role of standards and regula-

tion; the characteristics of major world systems and operators; and the thrust of new and future technology.

### Engineering 96.503W1 **Issues in Telecommunications**

Leaders of industry, academia and government discuss key issues and readings relevant to the telecommunications industry. Issues include the introduction of new products to the global market, technology sourcing, intellectual property rights, industry trends, technology and ethics, user interface design, new business opportunities and product identification, industry characteristics, regulation, and international competition.

### Engineering 96.504W1 **Management of Design Systems**

The focus is on how to design, maintain, expand and evolve an organization that delivers hardware, software and system designs, and on the frameworks, methods and tools used to improve its performance. Topics include the essence of design; unique aspects of designing telecommunications systems, products and services; characteristics of a development organization and its environment; mental models supporting the frameworks, methods and tools used to reduce interval, improve design quality and increase productivity; and applications.

Prerequisite: Engineering 96.501 and 96.502.

### Engineering 96.505S1 **Management of Telecommunications System Design**

The focus is on the groups that evolve the architecture and technological infrastructure of firms and product management. Topics include the relationships between architecture, system design, system product and product management; product function and performance; appropriability regimes; interdependence between technology and complementary assets; acquisition and diffusion of technology; evolution of design environments; integration of projects; and capability improvement models.

Prerequisite: Engineering 96.501 and 96.502.

### Engineering 96.506W1 **Management of Software Engineering Projects**

Models for software development life cycle. Earned-value models for project control. Software project management tools. Configuration management and quality control. Incorporation of testing tools and techniques in the software development life cycle. Risk assessment. Risk management. Examples are drawn from software development in telecommunications applications.

Prerequisite: Engineering 96.501 and 96.502.

Engineering 96.508S1

**Corporate Communications Networks**

Communications networks as a vital resource within organizations. Private networks as an infrastructure for information flow within a firm and across its interfaces. Applications and operations of corporate telecommunications networks. Information networking as a source of competitive advantage. Issues in the selection of corporate telecommunications architectures. Comparison of public and private corporate networks. Implementation issues.

Prerequisite: Engineering 96.501 and 96.502.

Engineering 96.510S1

**Communications Standards**

Importance of global standards in telecommunications and information technology for product development, business and society. Relevant public standards classified by type. National, international and quasi-standards bodies that establish public standards, their characteristics, roles and relationships. The standards setting process. Formulation and execution of standards strategies. Integrating the firm's standards program with engineering processes, product management, systems groups and marketing. Coordinating the network of internal and external groups involved in the development of standards to gain competitive advantage. Corporate standards. Standards conformance and inter-operability. Standards and the new product introduction process. Special topics pertaining to public and corporate standards.

Prerequisite: Engineering 96.501 and 96.502.

Engineering 96.511W1

**Integrated Product Development**

The new product introduction process and time-based competition, basic concepts of integrated product development (concurrent engineering), the voice of the customer, quality function deployment, cross-functional teams, integrating information systems and technical tools, organizational support, manufacturing and design, cost estimation, implementation problems.

Prerequisite: Engineering 96.501 and 96.502.

Engineering 96.512F1

**Managing Full-Scale Production**

Overall philosophy of just-in-time and time-based competition; just-in-time production and manufacturing resource planning; total quality management including vendor relations; socio-technical systems and employee participation; computer integrated manufacturing and advanced process technologies; manufacturing and facilities strategy, capacity planning; manufacturing flexibility; product/

process evolution and the experience curve; service aspects of manufacturing.

Prerequisite: Engineering 96.501 and 96.502.

Engineering 96.513F1,W1,S1

**Advanced Topics in Telecommunications Technology Management**

In-depth exploration of an advanced topic in the field of telecommunications technology management. A different topic is covered each semester and more than one section, with different topics, may be offered in the same semester.

Prerequisite: One of Engineering 96.504, 96.505, 96.511, or 96.512.

Engineering 96.514F1,W1,S1

**Directed Studies in Design and Manufacturing Management**

Directed by one or more instructors. The student explores, through extensive literature surveys, specific topics (not suitably covered by existing courses) in the areas of design and manufacturing management. The objective is to enable the student to study a specific topic to acquire a suitable background to initiate and complete thesis work requiring this preparation. Precludes credit for any other directed studies in the program.

Engineering 96.511F2,W2,S2

**M.Eng. Project**

Engineering 96.599F4,W4,S4

**M.Eng. Thesis**

Engineering 96.514F1,W1,S1

**Directed Studies in Design and Manufacturing Management**

Directed by one or more instructors. The student explores, through extensive literature surveys, specific topics (not suitably covered by existing courses) in the areas of design and manufacturing management. The objective is to enable the student to study a specific topic to acquire a suitable background to initiate and complete thesis work requiring this preparation. Precludes credit for any other directed studies in the program.

Engineering 96.591F2,W2,S2

**M.Eng. Project**

Engineering 96.599F4,W4,S4

**M.Eng. Thesis**



## Women's Studies

Loeb Building A812  
Telephone: 520-6645  
Fax: 520-2154

### The Institute

**Director, Katherine Arnup**

The Pauline Jewett Institute of Women's Studies does not offer a program at the graduate level. However, it does offer graduate-level courses which can, with the permission of the school, institute, or department in which the student is enrolled, be used towards a degree program.

### Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings for 1999-2000, please consult the *Registration Instructions and Class Schedule* booklet published in the summer.

F,W,S indicates term of offering. Courses offered in the fall and winter are followed by T. The number following the letter indicates the credit weight of the course: 1 denotes 0.5 credit, 2 denotes 1.0 credit, etc.

Women's Studies 09.500F1 or W1

#### **Issues for Feminist Scholarship**

The seminar is designed to inform students about the inception and the development of feminist scholarship in Canada and internationally, and to encourage critical analysis of such questions as the connection between feminist scholarship and feminist activism; the benefits and the hazards of interdisciplinary research; the importance of making interconnections between analyses of gender and analyses of social class, race/ethnicity, and sexual orientation; and the challenge of integrating feminist research into the traditional disciplines. While the course focuses primarily on developments in a selection of disciplines in the humanities and the social sciences, students interested in gender as a category of analysis are eligible to enroll in this course from all faculties, including science and engineering.

Prerequisite: Graduate standing and permission of the Institute.

Women's Studies 09.501F1 or W1

#### **Research Seminar in Women's Studies**

A seminar in which each student undertakes a cross-disciplinary research project for which gender is a primary category of analysis.

Prerequisite: Women's Studies 09.500 and permission of the Institute.

## **General Information**

- Faculty
- Milestones
- Officers of the University
- Public Lectures

## Calendar of Milestones

### The Institution

**1942**

The Ottawa Association for the Advancement of Learning was established to develop Carleton College. The College offered only evening classes in introductory university subjects, with some courses in public administration.

**1943**

The Ottawa Association for the Advancement of Learning was incorporated and the Institute for Public Administration was established.

**1945**

Beginning of day classes and full-time teaching in arts, science, journalism, and first-year engineering. Establishment of the Faculty of Arts and Science.

**1946**

Move from rented premises to First Avenue campus, formerly Ottawa Ladies' College. First degrees awarded in journalism and public administration.

**1947**

The College committed itself to develop pass and four-year honours programs.

**1949**

First undergraduate pass degrees in arts, science, and commerce awarded. Formation of Senate.

**1950**

First honours degrees in arts and science awarded.

**1952**

The Carleton College Act, 1952 passed by the Ontario Legislature. This changed the corporate name to Carleton College and confirmed the power to grant degrees. Property for Rideau River campus acquired.

**1953**

Establishment of the School of Public Administration.

**1954**

Appointment of Architectural Associates for Carleton to prepare a master plan for Rideau River campus, and to design the first group of buildings. First honorary degree (LL.D.) conferred on Dag Hammarskjöld, Secretary-General of the United Nations.

**1955**

First Master of Arts degree awarded.

**1957**

The Carleton University Act, 1957. Establishment of the School of Engineering. Establishment of the Institute of Canadian Studies.

**1958**

First Master of Science degree awarded.

**1959**

Move to Rideau River campus, following construction of the Henry Marshall Tory Building (science), the Maxwell MacOdrum Library, and Norman Paterson Hall (arts).

**1961**

First Ph.D. degree in science awarded. First degrees in engineering awarded.

**1962**

Southam Hall, the University Commons, Renfrew House and Lanark House (residences) completed. Norman Paterson Hall extended, and University Union opened.

**1963**

First Master of Engineering degree awarded. Reorganization into the Faculties of Arts, Engineering, Science, and Graduate Studies and Research.

**1964**

The C.J. Mackenzie Building (engineering) completed.

**1965**

The E.W.R. Steacie Building (chemistry), Grenville House and Russell House (residences), Maintenance Building, and Heating Plant completed.

**1966**

First Ph.D. degree in engineering awarded. The Physics Building completed (designated in 1972 as the Herzberg Laboratories for Physics). Establishment of the Schools of International Affairs and Commerce.

**1967**

Loeb Building (social sciences) completed. Integration of St. Patrick's College as a division of the Faculty of Arts. Integration of the School of Social Work.

**1968**

First Ph.D. degree in arts awarded. First Master of Social Work degree awarded. Establishment of the School of Architecture.

**1969**

Controlled Environmental Facility (biology), Administration Building, Glengarry House (residence), and University Commons (residence cafeteria) completed.

**1970**

University Centre and Parking Garage completed.



1971

Arts Tower completed.

1972

Architecture Building completed. School of Social Work accommodated on the Rideau River campus.

1973

St. Patrick's College moves to new facility on the Rideau River campus. First degrees in architecture awarded. New athletic complex containing 50-metre pool and fitness centre opened. School of Industrial Design established.

1974

Faculty of Graduate Studies and Research expanded into the Faculty of Graduate Studies and Research. School of International Affairs renamed the Norman Paterson School of International Affairs. Master of Journalism program approved for September 1974. Master of Arts programs in anthropology and in religion approved for September 1975. Program leading to Certificate in the Teaching of English as a Second Language established.

1975

Lester B. Pearson Chair for International Affairs approved for January 1, 1975. Establishment of Gerhard Herzberg Lecture Series in Science.

1976

First Dunton Alumni Award presented, January 1976. Creation of the Paterson Centre for International Programs in March 1976. Division of the Faculty of Arts into two separate faculties: the Faculty of Arts and the Faculty of Social Sciences, effective July 1976. First Master of Journalism degrees awarded, November 1976.

1977

Opening of the Criminology and Corrections concentration at St. Patrick's College, April 1977.

1978

School of Continuing Education established. Credit courses offered on cable television for the first time. Institute of Biochemistry established.

1979

St. Patrick's College ceased to operate as an academic unit of the University. Academic programs of the college continue as University programs, except for the Unified Liberal Arts Program.

1980

Establishment of the School of Computer Science. Establishment of the Chair of Office Automation in the Faculty of Engineering.

1981

Establishment of the Ottawa-Carleton Institute for Graduate Studies and Research in Chemistry, a joint program with the University of Ottawa. Establishment of a joint Ph.D. program in economics with the University of Ottawa.

1982

Establishment of the Ottawa-Carleton Centre for Geoscience Studies, representing the combined research strengths of Carleton University and the University of Ottawa, with programs leading to M.Sc. and Ph.D. degrees in most areas of geology. Establishment of a joint master's program in computer science with the University of Ottawa.

1983

Establishment of four joint graduate programs with the University of Ottawa: the Ottawa-Carleton Centre for Graduate Studies and Research in Biology; the Ottawa-Carleton Centre for Graduate Studies and Research in Physics; the Ottawa-Carleton Institute for Graduate Studies and Research in Electrical Engineering; and the Ottawa-Carleton Graduate Specialization in Neuroscience.

1984

Establishment of three joint graduate programs with the University of Ottawa in the areas of civil engineering, mechanical and aeronautical engineering, and mathematics and statistics.

1985

Master of Management Studies program established in the School of Business. The School of Public Administration offers a concentration in development administration in conjunction with the Norman Paterson School of International Affairs. An additional floor on one wing of the Herzberg Laboratories for Physics is constructed to house the School of Computer Science.

1986

The Social Sciences Research Building, the first new building on campus in a decade, is built to accommodate the rapidly-expanding research activity in the Faculty of Social Sciences. Construction of an annex on top of the Architecture Building to provide additional space for the Faculty of Engineering.

1987

The Institute of Women's Studies is established. The Arts Tower is renamed Davidson Dunton Tower/ Edifice Davidson Dunton in honour of Arnold Davidson Dunton, former Carleton University President and Director of the Institute of Canadian Studies. Major revisions to the Undergraduate Ex-

change Agreement with the University of Ottawa extend opportunities for students to study at both universities. The University launches the Carleton University Challenge Fund, the largest fund-raising campaign in its history.

### **1988**

Canada's first full Bachelor of Engineering program in Aerospace Engineering is established. Bell-Northern Research Limited and the Natural Sciences and Engineering Research Council provide funding for an Industrial Research Chair in Computer-Aided Engineering within the Department of Electronics. The Departments of Electronics and Systems and Computer Engineering are major partners in the Telecommunications Research Institute of Ontario (TRIO), one of seven "centres of excellence" chosen by the provincial government for scientific research. The Faculty of Science introduces cooperative education programs in computer science and biochemistry/biotechnology.

### **1989**

The University launches its first major program of construction and renovation in more than 20 years. Four capital projects are initiated: an addition to the MacOdrum Library; the Minto Centre for Advanced Studies in Engineering; a 400-bed residence building; and an addition to Southam Hall. A fifth project, the Life Sciences Research Building, is completed in 1989. The Institute of Political Economy is established. The Canadian Centre for Trade Policy and Law, a joint initiative of the Norman Paterson School of International Affairs at Carleton and the Faculty of Law at the University of Ottawa, is established.

### **1990**

A new Ph.D. program in computer science, offered jointly with the University of Ottawa, is established. The University introduces a Bachelor of Social Work degree program. The Paul Menton Centre for Persons with Disabilities is opened. The Centre for Research in Particle Physics is established to carry on the work of the National Research Council's large-scale physics projects.

### **1991**

Establishment of the Carleton University Development Corporation. \$11 million extension to the MacOdrum Library opened. The university's \$30 million Challenge Fund campaign surpassed its goal; \$1.5 million "enhancement" campaign announced. Registrarial services for arts and social sciences re-organized into two separate offices. Establishment of the Centre for Analytical and Environmental Chemistry. Establishment of the School of Comparative Literary Studies. Establishment

of the School for Studies in Art and Culture (bringing together the Departments of Art History, Film Studies, and Music). Establishment of the international exchange agreement between Carleton University, four Swedish universities, and three other Canadian universities (Laval, York, and the University of British Columbia). Establishment of the Carleton University/Polish faculty exchange agreement. Establishment of the Chair for Management in Technological Change. Establishment of M.A. programs in political economy, communication, legal studies, and applied language studies. Establishment of the women's history field in the Ph.D. program in history. Establishment of the Ph.D. program in public policy in the School of Public Administration.

### **1992**

The University celebrates its 50th anniversary. Institute for Interdisciplinary Studies, which includes a new B.A. program in environmental studies, is established. Department of Civil Engineering renamed Department of Civil and Environmental Engineering to reflect emphasis on the environment and new undergraduate program in environmental engineering. School of Journalism renamed School of Journalism and Communication, and Institute of Canadian Studies becomes School of Canadian Studies. The Centre for Aboriginal Education, Research and Culture is established. A new Ph.D. program in public policy, the first of its kind in Canada, is offered by the School of Public Administration, and a master's program in Canadian art history is introduced. The Carleton University Art Gallery and the Minto Centre for Advanced Studies in Engineering are opened. The Governor General of Canada and Head of the Canadian Heraldic Authority, His Excellency the Right Honourable Ramon John Hnatyshyn, grants the arms and flag of Carleton University at the fall convocation ceremonies.

### **1993**

Centre for Memory Assessment and Research established. Teaching and Learning Resource Centre established. Institute of Soviet and East European Studies renamed Institute for Central/East European and Russian Area Studies. Carleton University hosts the 1993 Learned Societies Conference. Construction begins on new Inco Centre. Institute of Women's Studies renamed Pauline Jewett Institute of Women's Studies. Administration Building renamed Robertson Hall.

### **1994**

New Industrial Research Chair in Performance Engineering of Real-Time Software established. The Inco Centre officially opened.

Research Facility for Electron Microscopy opened. New Ph.D. program in Public Policy established. New Bachelor of International Business program approved. Colonel By Child Care opened. Construction begins on the new Carleton Technology and Training Centre.

#### 1995

Carleton Technology and Training Centre opened. Bachelor of Humanities undergraduate degree program established. College of the Humanities approved.

#### 1997

Two new faculties created: the Faculty of Arts and Social Sciences and the Faculty of Public Affairs and Management. Department of Religion joined the College of the Humanities. School of Architecture modified its program to create a four-year degree program, with the professional designation provided by the two-year master's program. Bachelor of Arts program improved with standardization of programs across all departments and introduction of programs to allow students to improve their academic skills and to "tailor" their degrees to specific goals. Physics undergraduate degree program replaced with an applied physics program. Several small language programs closed: German, Italian, Russian, Spanish) as well as undergraduate programs in Comparative Literary Studies and Classics. New undergraduate program in Communications Engineering established. Co-operative education programs offered in all engineering programs.

The following graduate programs were established: Ph.D. in Cognitive Science; Ph.D. in Communications; Master of Arts in Film Studies; Master of Public Administration (with a Concentration in Innovation, Science, and Technology Policy); and the Graduate Certificate in Conflict Resolution.

#### 1998

Faculty of Science realigned its departments into the College of Natural Sciences and the School of Mathematics and Statistics. Centre for Initiatives in Education added to the Faculty of Arts and Social Sciences. Department of Geography renamed the Department of Geography and Environmental Studies.

Two new degree programs created: Bachelor of Mathematics and Bachelor of Public Affairs and Policy Management. Two new programs added to the Bachelor of Arts degree program: Art and Culture, and Criminology and Criminal Justice.

New programs established in Computational Chemistry, Engineering Physics and Software Engineering. Master of Science in Information and Systems Science (MScISS) program expanded.

School of Computer Science established a computer retraining certificate program. Office to coordinate co-op placements for engineering and science students opened.

### Chancellors

#### 1952 - 1954

Harry Stevenson Southam

#### 1954 - 1968

Chalmers Jack Mackenzie

#### 1969 - 1972

Lester Bowles Pearson

#### 1973 - 1979

Gerhard Herzberg

#### 1980 - 1990

Gordon Robertson (Emeritus 1992 - )

#### 1990 - 1992

Pauline Jewett

#### 1993 -

Arthur Kroeger

### Presidents

#### 1942 - 1947

Henry Marshall Tory

#### 1947 - 1955

Murdoch Maxwell MacOdrum

#### 1955 - 1956

James Alexander Gibson (acting)

#### 1956 - 1958

Claude Thomas Bissell

#### 1958 - 1972

Arnold Davidson Dunton

#### 1972 - 1978

Michael Kelway Oliver

#### January 1 - May 15, 1979

James Downey (pro tempore)

#### 1979 - 1989

William Edwin Beckel

#### 1989 - 1996

Robin Hugh Farquhar

#### 1996 -

Richard J. Van Loon



## Faculty

The following members of the faculty of Carleton University, together with Adjunct Research Professors, have been approved as supervisors of graduate theses and research essays, under criteria established by the Senate of the University. Since some appointments will be made subsequent to the publication deadline for this calendar, students are advised to consult their department for a complete list.

### Architecture

**K.S. Andonian**, *M.Arch. (Yerevan Polytechnic), M.A.Sc., Ph.D. (Waterloo), M.R.A.I.C.*

**J.B. Bell**, *B.E.S., B.Arch. (Waterloo), M.Phil. (Cambridge)*

**Martin Bressani**, *B.Sc., M.Arch. (McGill), M.Sc. (M.I.T.), Dr. d'Univ. (Paris-Sorbonne)*

**Y. Czazbon**, *dipl. A.T., B.Arch. (Carleton), M.Arch. (McGill), M.R.A.I.C.*

**Tom Dubicanac**, *B.Arch., M.Arch. (Detroit)*

**S. Fai**, *B.Arch. (Toronto), B.A., M.A. (Ottawa), M.R.A.I.C.*

**L. Fontein**, *B.Arch. (Toronto), M.Arch. (McGill), O.A.Q.*

**Benjamin Gianni**, *B.A. (Pennsylvania), M.Arch. (Yale)*

**C.C. Gordon**, *B.A. (Amherst), Ph.D. (North Carolina)*

**S.G. Haider**, *B.Sc. (West Pakistan), M.S., B.Arch., Ph.D. (Illinois)*

**H.S. Loten**, *B.Arch., M.Arch. (Toronto), Ph.D. (Pennsylvania), M.R.A.I.C.*

*Adjunct Research Professors*

**J.W. Archer**, *B.A. (McGill), B.Arch., M.A. (Carleton)*

**John Cook**, *D.Arch. (Cambridge), M.A. (Cambridge)*

**B.M. Firestone**, *B.Eng. (McGill), M.Eng. (Univ. of New South Wales), Ph.D. (Australian Nat. Univ.)*

**S. Grossman-Hensel**, *D.Arch. (Werkkunst Schule, Krefeld)*

**A. Rankin**, *D.Arch.*

### Studies in Art and Culture

**Geraldine Finn**, *B.A. (Keele), M.A. (McMaster), Ph.D. (Ottawa)*

### Art History

**Michael Bell**, *B.A., M.A. (Toronto)*

**A.K. Carr**, *LL.B. (York), B.A., M.A., Phil.M., Ph.D. (Toronto)*

**K.J. Crossman**, *B.A. (Winnipeg), M.A. (Toronto), Ph.D. (Edinburgh)*

**Randi Klebanoff**, *B.A. (Concordia), M.A. (British Columbia), Ph.D. (Harvard)*

**Natalie Luckyj**, *B.A., M.A. (Toronto)*

**Roger Mesley**, *B.A., M.A., Ph.D. (Toronto)*

**C. Payne**, *B.F.A. (York), M.A., Ph.D. (Boston)*

*Adjunct Research Professors*

**Rosemarie Bergmann**, *B.L.S. (McGill), Ph.D. (Marburg)*

**T.J.C. Brasser**, *Cand. C.A., Drs. (Leiden)*

**Christina Cameron**, *B.A. (Toronto), M.A. (Brown), Ph.D. (Laval)*

**Stephen Inglis**, *B.A. (British Columbia), M.A. (Calcutta), Ph.D. (British Columbia)*

**M.E. Jackson**, *A.B., M.A., Ph.D. (Michigan)*

**Lilly Koltun**, *B.A. (Toronto), M.A. (London)*

**Andrea Laforet**, *B.A., Ph.D. (British Columbia)*

**George MacDonald**, *B.A. (Toronto), Ph.D. (Yale)*

**D. Nemiroff**, *B.F.A., M.A. (Concordia)*

### Film Studies

**C.G. Faulkner**, *B.A. (Sir George Williams), M.A. (Western)*

**Mark Langer**, *B.A. (Western), M.F.A., M.Phil. (Columbia)*

**A. Loiseau**, *B.A. (Québec at Montréal), M.A., Ph.D. (British Columbia)*

**L.U. Marks**, *B.A. (Swarthmore), M.A., Ph.D. (Rochester)*

**George McKnight**, *B.A. (British Columbia), M.A. (McMaster), Ph.D. (Toronto)*

**Charles O'Brien**, *B.A. (Nebraska), Ph.D. (Iowa)*

**Z.M. Pick**, *Licencès-Lettres, Maitrise, D. de 3<sup>e</sup> cycle, (Paris)*

*Adjunct Research Professors*

**Blaine Allen**, *B.A. (Queen's), M.A. (Northwestern), Ph.D. (Northwestern)*

**Peter Baxter**, *B.A. (Windsor), M.A. (Simon Fraser), Ph.D. (London)*

**Peter Harcourt**, *B.A., M.A. (Downing College), (Cambridge)*

**Music**

**P.R.T. Cardy**, B.Mus. (Western Ontario), M.M.A., D.Mus. (McGill)

**B.R. Gillingham**, A.R.C.T., B.A., B.Mus. (British Columbia), M.Mus. (Kings College), Ph.D. (Washington)

**A.M. Gillmor**, B.Mus., M.A. (Michigan), Ph.D. (Toronto)

**Elaine Keillor**, A.R.C.T., B.A., M.A., Ph.D. (Toronto)

**John Shepherd**, A.R.C.M., B.A., B.Mus. (Carleton), D.Phil. (York)

*Adjunct Research Professors*

**Violet Archer**, B.Mus., M.Mus. (Yale), A.C.C.O., L.Mus., D.Mus. (McGill)

**D.R. Gardner**, B.Sc., Ph.D. (Southampton)

**Helmut Kallmann**, B.Mus. (Toronto)

**Peter Wicke**, Ph.D. (Humboldt University)

**Biology**

**N. Cappuccino**, A.B. (Brown Univ., Rhode Is.), Ph.D. (Cornell)

**G.R. Carmody**, A.B., Ph.D. (Columbia)

**Nathalie Chaly**, B.Sc., M.Sc. (Carleton), Ph.D. (Laval)

**J. Cheetham**, B.Sc., Ph.D. (McMaster)

**Hans Damman**, B.Sc. (Connecticut), Ph.D. (Cornell)

**Lenore Fahrig**, B.Sc. (Queen's), M.Sc. (Carleton), Ph.D. (Toronto)

**Mark Forbes**, B.Sc. (Acadia), M.Sc. (Western Ontario), Ph.D. (Toronto)

**K. Gilmour**, B.Sc. (McMaster), Ph.D. (Cambridge)

**H.F. Howden**, B.A., M.S. (Maryland), Ph.D. (North Carolina) Professor Emeritus

**V.N. Iyer**, M.Sc., Ph.D. (Bombay) Professor Emeritus

**Iain Lambert**, B.Sc. (Guelph), Ph.D. (McMaster)

**M.E. McCully**, M.S.A. (Toronto), Ph.D. (Harvard)

**S.B. Peck**, B.S. (Kentucky), M.S. (Northwestern), Ph.D. (Harvard)

**John Sinclair**, B.Sc., Dip. in Biophysics (Edinburgh), Ph.D. (East Anglia)

**Myron Smith**, B.Sc. (Alberta), M.Sc., Ph.D. (Toronto)

**K.B. Storey**, B.Sc. (Calgary), Ph.D. (British Columbia)

**J.P. Vierula**, B.Sc. (York), Ph.D. (Calgary)

**P.J. Weatherhead**, B.Sc. (Carleton), M.Sc., Ph.D. (Queen's)

**R.C. Wyndham**, B.Sc. (McMaster), M.Sc. (Guelph), Ph.D. (Calgary)

*Adjunct Research Professors*

**S.P.J. Brooks**, B.Sc., M.Sc. (Brock), Ph.D. (Michigan)

**K. Freemark**, B.Sc. (Queen's), Ph.D. (Carleton)

**W.D. Gould**, B.Sc. (Manitoba), M.Sc., Ph.D. (Alberta)

**B.F. Johnson**, B.Sc. (Penn State), M.Sc., Ph.D. California

**L.R. Lefkovitch**, B.Sc., D.Sc. (London)

**H.G. Merriam**, B.Sc. (Guelph), Ph.D. (Cornell) Professor Emeritus

**B.L.A. Miki**, B.Sc. (Toronto), Ph.D. (Carleton)

**Pierre Mineau**, B.Sc. (McGill), M.Sc., Ph.D. (Queen's)

**V.L. Seligy**, B.Sc., M.Sc., Ph.D. (Toronto)

**P.R. Walker**, B.Sc., Ph.D. (Sheffield)

**Hiroshi Yamazaki**, M.S. (Hokkaido), Ph.D. (Wisconsin)

*Honorary Research Professors*

**M.J. Canny**, M.A., Ph.D. (Cambridge)

**D.M. Wood**, B.A., M.A. (Toronto), Ph.D. (McMaster)

**Business**

**A.J. Bailetti**, B.Sc., Univ. National de Ingenieria, Peru) M.B.A., Ph.D. (Cincinnati)

**J.R. Callahan**, B.Sc. (Carleton), M.A., Ph.D. (Toronto)

**David Cray**, B.A. (New College), M.S., Ph.D. (Wisconsin)

**L.E. Duxbury**, B.Sc., M.A.Sc., Ph.D. (Waterloo)

**Lorraine Dyke**, B.A. (Ottawa), M.B.A., Ph.D. (Queen's)

**Donald Gerwin**, B.S. (Carnegie-Mellon), M.S. (Case Western Reserve), Ph.D. (Carnegie-Mellon)

**G. Grant**, B.Sc., M.B.A., (Andrews), Ph.D. (London School of Economics)

**G.H. Haines, Jr.**, S.B. (M.I.T.), M.S., Ph.D. (Carnegie Institute of Technology)

**Oscar Hauptman**, B.Eng., M.Sc. (Israel Institute of Technology Technion), Ph.D. (M.I.T.)

## Faculty

**L.A. Heslop**, B.H.Sc., M.Sc. (*Guelph*), Ph.D. (*Western Ontario*)

**V.M. Jog**, B.Eng. (*Birla Institute*), M.Eng., M.B.A., Ph.D. (*McGill*)

**G.E. Kersten**, M.A., Ph.D. (*Central School of Planning and Statistics, Warsaw*)

**M.N. Kiggundu**, B.A. (*Makerere*), M.B.A. (*Alberta*), Ph.D. (*Toronto*)

**Uma Kumar**, B.Sc. (*Agra*), M.Sc. (*Kanpur*), M.Sc. (*Manitoba*), Ph.D. (*Kanpur*)

**Vinod Kumar**, B.Sc. (*Agra*), B.Eng. (*Roorkee*), M.Eng. (*California, Berkeley*), Ph.D. (*Manitoba*), P.Eng.

**Ian Lee**, B.A., M.A., Ph.D. (*Carleton*)

**J.J. Madill**, B.H.Sc., M.Sc. (*Manitoba*), Ph.D. (*Western Ontario*)

**Bruce McConomy**, B.Com., Ph.D. (*Queen's*)

**Wojciech Michalowski**, M.Sc., Ph.D. (*Central School of Planning and Statistics, Warsaw*)

**Siva Pal**, B.E. (*Burdwan*), M.S. (*Wayne State*), M.A.Sc., Ph.D. (*Waterloo*), P.Eng.

**Nicolas Papadopoulos**, B.B.A. (*Athens Graduate School of Economics and Business*), M.B.A. (*Washington State*), D.B.A. (*Athens*)

**A. Ramirez**, B.Sc. (*Instituto Tecnologico y de Estudios Superiores de Monterrey, Mexico*) M.Sc., (*Syracuse*), Ph.D., (*Concordia*)

**A.L. Riding**, B.Eng., M.Eng. (*McGill*), M.B.A. (*Sir George Williams*), Ph.D. (*McGill*)

**A.K. Srivastava**, B.Eng. (*Birla*), M.B.A. (*Concordia*), Ph.D. (*Toronto*)

**D.R. Thomas**, B.Sc. (*Imperial College*), M.Sc. (*Carleton*), Ph.D. (*Imperial College*)

### Adjunct Research Professors

**Christopher Higgins**, B.Math., M.A. Math., Ph.D. (*Waterloo*)

**I. Kaliszewski**, M.Eng. (*Technical Univ. of Warsaw*), Ph.D., D.Sc. (*Polish Academy of Sciences*)

**S. Maguire**, B.A. (*Ottawa*), M.A., Ph.D. (*Queen's*)

**G.R. Mallory**, B.Sc. (*Bradford*), M.A. (*Leeds*), Ph.D. (*Bradford*)

**Darren Meister**, B.A.Sc. (*Waterloo*), Cip. Comp. Sci. (*Cambridge*), M.A.Sc., Ph.D. (*Waterloo*)

**Zbigniew Mikolajuk**, M.S., Ph.D. (*Warsaw*)

**S.Y. Noronha**, B.Tech. (*Indian Institute of Technology*), Ph.D. (*Indian Institute of Science*)

**Barbara Orser**, B.A., (*Waterloo*), M.B.A., (*York*, Ph.D., (*Bradford*)

**Stan Szpakowicz**, M.A. Math., Ph.D. (*Warsaw*)

## Canadian Studies

**Pat Armstrong**, B.A. (*Toronto*), M.A., Ph.D. (*Carleton*)

**Katherine Arnup**, B.A. (*Toronto*), B.Ed., M.Ed. (*O.I.S.E.*), Ph.D. (*Toronto*)

**Madeleine Dion Stout**, B.N. (*Lethbridge*), M.A. (*Carleton*)

**Stanley McMullin**, B.A., M.A. (*Carleton*), Ph.D. (*Dalhousie*)

**Pauline Rankin**, B.A. (*Toronto*), M.A., Ph.D. (*Carleton*)

**J. Smith**, B.A. (*Oberlin College*), M.Arch. (*Massachusetts Institute of Technology*), O.A.A., M.R.A.I.C.

### Adjunct Professors

**J.B. Carroll**, B.Arch. (*North Carolina State*), M.R.P. (*North Carolina*)

**David Hawkes**, B.A. (*Saskatchewan*), M.A. (*Queen's*)

### Adjunct Research Professors

**Rt. Honourable Joe Clark**, B.A., M.A., LL.D. (*Alberta*)

**Heather Menzies**, B.A. (*McGill*)

**J.E. Page**, B.A., M.A. (*Queen's*)

### Fellows

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**A.D. Steeves**, M.S.A. (Toronto), Ph.D. (Michigan)

**G.M. Torrance**, B.A., M.A., Ph.D. (Toronto)

## Systems and Computer Engineering

**V. Aitken**, B.A.Sc. (British Columbia), M.Eng., Ph.D. (Carleton)

**A.J. Bailetti**, B.Sc. (Univ. National de Ingenieria, Peru), M.B.A., Ph.D. (Cincinnati)

**A.H. Banihashemi**, B.Sc. (Isafahan University of Technology), M.Sc. (Tehran University), Ph.D. (Waterloo)

**R.J.A. Buhr**, B.Sc. (Queen's), M.Sc. (Saskatchewan), Ph.D. (Cambridge)

**J.R. Callahan**, B.Sc. (Carleton), M.A., Ph.D. (Toronto)

**J.W. Chinneck**, B.A.Sc., M.A.Sc., Ph.D. (Waterloo)

**D.C. Coll**, M.Eng. (McGill), Ph.D. (Carleton)  
*Professor Emeritus*

**Mihail Devetsikiotos**, Dipl. Elect. Eng. (Thessaloniki), M.Sc., Ph.D. (North Carolina)

**M.S. El-Tanany**, B.Sc., M.Sc. (Cairo), Ph.D. (Carleton)

**D.D. Falconer**, B.A.Sc. (Toronto), S.M., Ph.D. (M.I.T.)

**M. Frize**, B.A.Sc. (Ottawa), M.Phil., D.I.C. (Imperial), M.B.A. (Moncton), Ph.D. (Erasmus)

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**T. Kunz**, Diplom., Ph.D. (Darmstadt)

**Ioannis Lambadaris**, B.Eng. (Thessaloniki), M.Sc. (Brown), Ph.D. (Maryland)

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**Bernard Pagurek**, M.A.Sc., Ph.D. (Toronto)

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**J.S. Riordon**, M.Eng. (McGill), D.I.C. (Imperial), Ph.D. (London)

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**H. Yanikomeroglu**, B.Sc. (Middle East Technical University), M.A.Sc., Ph.D. (Toronto)

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**A. Bieszczod**, M.I. (*Jagiellonian*), M.C.S., Ph.D. (*Carleton*)

**G.D. Boudreau**, B.A.Sc. (*Ottawa*), M.Sc. (*Queen's*), Ph.D. (*Carleton*)

**R.J.C. Bultitude**, B.Sc. (*New Brunswick*), M.Eng., Ph.D. (*Carleton*)

**S.N. Crozier**, B.Sc. (*Queen's*), M.Eng., Ph.D. (*Carleton*)

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**S. Periyalwar**, B.Eng. (*Bangalore*), M.A.Sc., Ph.D. (*Technical University of Nova Scotia*)

**Leo Strawczynski**, B.Sc., M.Sc. (*McGill*), Ph.D. (*Rochester*)

**C.R. Walker**, F.R.C.P. (C) (*Royal College of Physicians and Surgeons of Canada*), M.B., Ch.B. (*University of Manchester*)

**Y. Wu**, B.Eng. (*Beijing University of Telecommunications*), M.Eng., Ph.D. (*Carleton*)

## Women's Studies

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**Fran Klodawsky**, B.A. (*Toronto*), M.A. (*Ohio State*), Ph.D. (*Queen's*)

**Susan Whitney**, B.A. (*Princeton*), M.A. (*Brown*), Ph.D. (*Rutgers*)

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**Heather Menzies**, B.A. (*McGill*)

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**N.E.S. Griffiths**, B.A. (*London*), M.A. (*New Brunswick*), Ph.D. (*London*), Doct. d'Hist. (*Université de Moncton*), Doct. d'Hist., (Ste-Anne, N.S.), Doc. Hum. Lett. (*Mount St. Vincent*), F.R.S.C.

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**H.B. Neatby**, M.A. (*Oxford*), Ph.D. (*Toronto*), F.R.S.C.

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**E.M. Oppenheimer**, B.A. (*Toronto*), M.A. (*Columbia*), Ph.D. (*Harvard*)

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The President and Vice-Chancellor

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Michael Smith, B.Sc., M.A., Ph.D.

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Colin Betts, B.A. (Hons.)

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Linda Duxbury, B.Sc., M.A.Sc., Ph.D.

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##### *Retire June 30, 2001*

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Associate Professor J.W. Chinneck, B.A.Sc., M.A.Sc., Ph.D., P.Eng.

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Professor F. Dehne, B.Sc., M.Sc., Ph.D.

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Ms DeAnn Foreman

Associate Professor L. Frankel, B.F.A., Masters, M.E.D.

Professor B. Gillingham, B.A., B.Mus., M.Mus., Ph.D.

Associate Professor S. Godfrey, B.A.Sc., M.Sc., Ph.D.

Associate Professor R.A. Goubran, B.Sc., M.Sc., Ph.D., P.Eng.

Associate Professor R. Jeffreys, B.A., M.A., Ph.D.

Professor Vinod Kumar, B.Sc., B.Eng., M.Eng., Ph.D., P.Eng.

Associate Professor M. Langer, B.A., M.F.A., M.Phil.

Associate Professor S. Lipsett-Rivera, B.A., M.A., Ph.D.

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Associate Professor M. Mac Neil, B.Sc., LL.B., LL.M.

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Associate Professor K. Matheson, B.A., M.A., Ph.D.

Associate Professor M.J. McDill, B.Eng., M.Eng., Ph.D., P.Eng.

Associate Professor L.T.R. McDonald, B.A., M.A., Ph.D.

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Associate Professor S.E. Mills, B.Sc., M.Sc., Ph.D.

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Professor I.W.V. Pringle, M.A.

Associate Professor S. Robinson, B.A., M.A.

Assistant Professor D. Rosse, Les L., M.A., Ph.D.

Associate Professor P.N. Rowe, B.A., M.A., Ph.D.

Professor M.W. Smith, B.Sc., M.A., Ph.D.

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Professor C.L. Tan, B.Sc., Ph.D.

Professor D.R. Thomas, B.Sc., Ph.D., M.Sc.

Mr. Ryan S. Ward

Mr. Thane Wilson

#### *Special Appointments*

Associate Professor R. Bird, B.A., M.A., Ph.D.

Professor C.H. Chan, B.Sc., M.A.Sc., Ph.D., P.Eng. (Clerk of Senate)

Mr. Martin Foss, B.A., B.L.S.

Mr. D. Thomson, M.C.S.

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## Public Lectures

### Major Lecture Series

A distinguished series of lectures supported by Carleton University faculties.

#### The Florence Bird Lecture

This annual lecture was established in 1987 to explore the experiences of women in Canada and abroad. It is named in honour of the Honourable Florence Bird, in recognition of her work for the CBC, CIDA, the Royal Commission on the Status of Women in Canada, and the Senate. The lecture is sponsored jointly by the Faculty of Arts and Social Sciences.

#### The Davidson Dunton Research Lecture

Established in 1983, the Davidson Dunton Research Lecture is presented by a Carleton University scholar who is active in research and has achieved international recognition. The lecture is in honour of former Carleton University President Arnold Davidson Dunton.

#### The Gerhard Herzberg Lecture

Established in 1975 by the Faculty of Science, this lecture honours Gerhard Herzberg, a former Chancellor of Carleton University and recipient of the 1971 Nobel Prize for Chemistry. The purpose of the lecture is to emphasize the relationship between science and society and to address an aspect of science which has a pronounced impact on our daily lives.

#### The Marston LaFrance Research Fellowship Lecture

The fellowship was established in 1979 by the Faculty of Arts and Social Sciences in memory of Marston LaFrance, former Professor of English and Dean of Arts at Carleton University. Each year, the recipient presents a seminar or public lecture on some aspect of the research conducted while on the LaFrance fellowship.

#### The John Porter Memorial Lecture

This annual lecture is sponsored by the Faculty of Arts and Social Sciences in memory of John Porter, former Vice-President (Academic) at Carleton University and a distinguished sociologist. The series was established in 1982.

## Special Lectures

Individual lectures sponsored by various academic departments or endowments.

#### The Munro Beattie Lecture

This lecture was established in 1985 in honour of Alexander Munro Beattie, the founder and first Chair of the Department of English, in recognition of his outstanding contribution to Carleton University in teaching, scholarship and administration. The series is sponsored by the Department of English.

#### The Dick and Ruth Bell Lecture

Established in 1988 in honour of the late Dick Bell and Ruth Bell. The lecture will be delivered annually by distinguished scholars in the field of political science or by distinguished persons serving or having served in the public life of Canada or one of its provinces. Supported through the Dick and Ruth Bell Fund.

#### The Edgar and Dorothy Davidson Lecture

The Edgar and Dorothy Davidson Lecture was established in 1983 and is sponsored by the College of the Humanities. The lecture brings a prominent scholar in the area of religious studies and related areas to speak at Carleton.

#### The McMartin Memorial Lecture

The McMartin Memorial Lecture is presented in alternate years by the College of the Humanities at Carleton University and the Faculty of Graduate Studies and Research at the University of Ottawa. The series was established in 1969 and is funded by Mrs. J.P. Gilhooly of Ottawa in memory of her parents, Mr. and Mrs. John McMartin. The lectures involve themes which promote the importance of ethical, moral, and religious standards to education and living.

#### The Adam Mickiewicz Memorial Lecture

Established in 1969, the Adam Mickiewicz Memorial Lecture is presented each year by noted authorities in the area of Soviet and East European Studies. The series is sponsored by Carleton University's Institute of Central/East European and Russian-Area Studies and the Adam Mickiewicz Foundation of Canada to commemorate Poland's foremost poet, Adam Mickiewicz.



### **The H.H.J. Nesbitt Lecture**

This annual lecture series was established in 1987 by the Faculty of Science in honour of H.H.J. Nesbitt, Carleton University's first Dean of Science. The lectures are presented by Carleton alumni who have earned international recognition as scientists. The topics are of general interest to the public as well as the scientific community.

### **The Pickering Lecture**

Established in 1975, the Pickering lecture topics focus on problems of developmental and childhood psychology. The Pickering Lecture is sponsored by the Department of Psychology.

### **The Technology, Society, Environment Studies Committee Lecture**

Established in 1981 to sensitize the public to the impact of technology on society and the environment. The lecture is sponsored by the Technology, Society and Environment Studies Committee.

### **The Philip E. Uren Memorial Lecture**

The Philip E. Uren Memorial Lecture is sponsored by the Dean of the Faculty of Public Affairs and Management in memory of Philip Uren, former Director of the Institute of Soviet and East European Studies, the Normal Paterson School of International Affairs, and the Paterson Centre for International Programs at Carleton University. This annual lecture was established in 1982.

### **The Pickering Lecture**

Established in 1975, the Pickering lecture topics focus on problems of developmental and childhood psychology. The Pickering Lecture is sponsored by the Department of Psychology.

### **The Technology, Society, Environment Studies Committee Lecture**

Established in 1981 to sensitize the public to the impact of technology on society and the environment. The lecture is sponsored by the Technology, Society and Environment Studies Committee.

### **The Philip E. Uren Memorial Lecture**

The Philip E. Uren Memorial Lecture is sponsored by the Dean of the Faculty of Public Affairs and Management in memory of Philip Uren, former Director of the Institute of Soviet and East European Studies, the Normal Paterson School of International Affairs, and the Paterson Centre for International Programs at Carleton University. This annual lecture was established in 1982.

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## Notes

## Notes



## Notes

## Academic Units and Programs

### Department/School/Institute

Telephone \_\_\_\_\_ (613) 520-

Architecture _____	2855
Art History _____	2342
Biology, Ottawa- Carleton Institute _____	3888
Biostatistics _____	2152
Business _____	2388
Canadian Studies _____	2366
Chemistry, Ottawa-Carleton Institute _____	3589
Civil and Environmental Engineering _____	5784
Civil Engineering, Ottawa-Carleton Institute _____	3589
Cognitive Science _____	3597
Comparative Literary Studies _____	2177
Computer Science _____	4333
Computer Science, Ottawa-Carleton Institute _____	4333
Economics _____	3744
Electrical and Computer Engineering, Ottawa-Carleton Institute _____	5659
Electronics _____	5754
English Language and Literature _____	2310
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Film Studies _____	5606
French _____	2168
Geography and Environmental Studies _____	2561
Geoscience Centre, Ottawa-Carleton _____	4401
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Information and Systems Science _____	2155
Interdisciplinary Studies _____	2368
International Affairs _____	6655
Journalism and Communication _____	7404
Law _____	3690
Linguistics and Applied Language Studies _____	6613
Mass Communication _____	7408
Mathematics and Statistics, Ottawa-Carleton Institute _____	2152
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Mechanical and Aerospace Engineering, Ottawa-Carleton Institute _____	5659
Music _____	5770
Neuroscience _____	7493
Philosophy _____	2110
Physics, Ottawa-Carleton Institute _____	4377
Political Economy _____	7414
Political Science _____	2777
Psychology _____	2644
Public Administration _____	2547
Religion _____	2100
Social Work _____	5601
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